Inter-Space Utilization Through Garlic (*Allium sativum*) Production in Watermelon (*Cirullus lanatus*) Field in Coastal Saline Area

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**Abstract:** The experiment was conducted at farmer’s field of FSRD site, Hazirhat, Noakhali during Rabi season of 2011-2012 and 2012-13 to utilize inter-space of watermelon field through garlic production. The experiment consisted of 5 treatments as follows: T1 = Sole watermelon (Glory), T2 = Sole garlic (local), T3 = Watermelon + Local garlic, T4 = Watermelon + BARI Rashun-1 and T5 = Watermelon + BARI Rashun-2. Watermelon equivalent yield was maximum in treatment Watermelon + BARI Rashun-2 (48.46 t ha⁻¹) followed by Watermelon + BARI Rashun-1 (46.67 t ha⁻¹) and Watermelon + Local garlic (45.67 t ha⁻¹), respectively. Higher LER was recorded from the treatment Watermelon + BARI Rashun-2 (1.23) followed by Watermelon + BARI Rashun-1 (1.17). Land advantage of crop combination in different treatments ranges from 13 % to 23%. The higher Gross margin (Tk.282760 ha⁻¹) was obtained from the treatment Watermelon + BARI Rashun-2 which was followed by watermelon + BARI Rashun-1 (Tk.268430 ha⁻¹). Watermelon with garlic cultivation also showed higher BCR (3.48, 3.56 and 3.70) over sole watermelon and garlic cultivation (3.42 and 2.25), respectively. This obviously reflected the importance of intercropping to increase the productivity per unit area. Further, it also offers insurance against crop failure.

**Key words:** Inter-Space • Watermelon • Garlic • Land Equivalent Ratio • Equivalent Yield

**INTRODUCTION**

Watermelon (*Cirullus lanatus*) is one of the important nutritious, quick growing and short duration fruit crops in Bangladesh. Watermelon being a promising cash crop mainly at Subornachar and Noakhali Sador Upzilla under Noakhali district. It is cultivated according to pit (2m x 2m) basis. Inter-space between pit to pit remains fallow from seeding to harvesting in watermelon fields. Intercropping is the practice of growing two or more crops simultaneously in the same land area, particularly in the tropics [1]. It is a traditional method of crop production but it has not been widely practice by the farmers of Bangladesh. Sporadically farmers of saline coastal area practice this method according to their choice and need. Intercropping has several advantages over sole culture of crops, such as enhancement of efficient use of environmental factors (e.g., light, nutrient and soil moisture) and labors, reduces the adverse effect of various biotic and abiotic stress, provides diversity of food, generates more income, offers insurance against crop failure, higher return and total productivity per unit area. In that sense watermelon-garlic intercropping is a promising practice in coastal saline area. According to research findings of OFRD, BARI that watermelon and garlic can tolerate salinity level up to 6-10 dS m⁻¹ at fruiting stage [2]. So, there is a great scope to enhance watermelon and garlic production in coastal saline area. Watermelon and garlic is potential cash crop to the farmers. Farmers of Noakhali region grow local garlic variety due to lack of improved high yielding varieties. As a result they get lower yield. BARI has developed two high yielding varieties of garlic viz. BARI Rashun-1 and BARI Rashun-2. It has natural fungicidal and pesticidal properties that work effectively to control pests. The benefit of using garlic in mixed cropping is that it effectively repels harmful pests while retaining beneficial ones [3]. They usually cultivate watermelon and garlic as a sole crop. The average yield and maximum utilization of land can be increased through watermelon-garlic
intercropping. So, there is a great scope to enhance crop production through utilization of inter-space of watermelon field in this saline area by adopting salt tolerant crop like garlic with their modern varieties and thus can enhance food security. Keeping this in mind, the experiment is undertaken to utilize inter-space of watermelon field.

MATERIALS AND METHODS

The experiment was conducted at farmer’s field of FSRD site, Hazirhat, Noakhali during Rabi season of 2011-2012 and 2012-13. The soil of the experimental area belongs to Young Meghna Estuarine Floodplain (AEZ 18). The soil of the experimental plot was sandy loam in texture. The experiment was set in randomized complete block design with six dispersed replications having unit plot size of 10 m x 4m. The experiment consisted of 5 treatments are as follows: T1 = Sole watermelon (Glory), T2 = Sole garlic (local), T3 = Watermelon + Local garlic, T4 = Watermelon + BARI Rashun-1 and T5 = Watermelon + BARI Rashun-2. Proper spacing for watermelon (2 m X 2 m) and garlic as intercrop (25 cm X 15 cm) were maintained cautiously. The land was fertilized with 10 ton of decomposed cowdung and inorganic fertilizer @ 93-35-125-18 kg ha⁻¹ N-P-K-S, respectively (FRG, 2012). Entire amount of cowdung, P, S, half of MoP and 1/3rd urea were applied at the time of final land preparation. Remaining MoP and Urea were applied at two equal installments at 20 and 40 days after seeding. Watermelon seeds were sown and garlic cloves dibbling were done on 5-25 December in each year. The crop was irrigated thrice by jar during the crop period. Weeding and other intercultural operations were done as and when needed.

Garlic was harvested from 21 March to 7 April and watermelon was also harvested on 5 to 12 April. Total rainfall and soil salinity data were recorded during the experimental period and presented in Fig.1. Mean yield data from three farmer’s field were recorded and analyzed statistically. Watermelon equivalent yield (WEY), LER and BCR were calculated to ascertain the efficiency of intercropping. Watermelon equivalent yield was calculated by converting yield of intercrops to the yield of watermelon on the basis of prevailing market prices of individual crops. Economic analysis on the basis of net monetary return was performed to evaluate the intercropping system. Land Equivalent Ratio was calculated by using the equation [4] mentioned below:

\[
LER = \frac{\text{Yield of intercrop (Watermelon)} + \text{Yield of intercrop (Garlic)}}{\text{Yield of sole crop (Watermelon)} \times \text{Yield of sole crop (Garlic)}}
\]

Watermelon Equivalent Yield was calculated by using the equation [5] mentioned below:

\[
\text{Watermelon Equivalent Yield} = \frac{\text{Yield of Garlic (Kg ha}^{-1}) \times \text{Price of Garlic (Tk Kg}^{-1})}{\text{Price of Watermelon (Tk Kg}^{-1})}
\]

RESULTS AND DISCUSSION

Yield of Watermelon: The highest yield (36.12 t ha⁻¹) was found from the treatment T1 whereas the lowest yield (34.29 t ha⁻¹) was found in treatment T5 (Table1).

Yield of Garlic: The highest average yield (4.85) t ha⁻¹ was found from the treatment T5 i.e. sole garlic whereas the lowest average yield (2.60 t ha⁻¹) was found in treatment T5 (Watermelon + Local garlic) as intercropped.

Fig. 1: Comparative status of salinity and rainfall at FSRD site, Hazirhat, Noakhali during experimental period (2011-12 and 2012-13)
Table 1: Average Yield, WEY and LER of inter-space utilization through garlic production in watermelon field at FSRD site, Hazirhat, Noakhali during Rabi season of 2011-12 and 2012-13.

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Watermelon (t ha(^{-1}))</th>
<th>Garlic (t ha(^{-1}))</th>
<th>WEY (t ha(^{-1}))</th>
<th>LER</th>
</tr>
</thead>
<tbody>
<tr>
<td>T(_1)</td>
<td>34.35</td>
<td>-</td>
<td>34.35</td>
<td>1.00</td>
</tr>
<tr>
<td>T(_2)</td>
<td>34.35</td>
<td>4.85</td>
<td>21.22</td>
<td>1.00</td>
</tr>
<tr>
<td>T(_3)</td>
<td>34.29</td>
<td>2.60</td>
<td>45.67</td>
<td>1.13</td>
</tr>
<tr>
<td>T(_4)</td>
<td>35.16</td>
<td>2.63</td>
<td>46.67</td>
<td>1.17</td>
</tr>
<tr>
<td>T(_5)</td>
<td>36.12</td>
<td>2.82</td>
<td>48.46</td>
<td>1.23</td>
</tr>
</tbody>
</table>

T\(_1\) = Sole watermelon (Glory), T\(_2\) = Sole garlic (local), T\(_3\) = Watermelon + Local garlic, T\(_4\) = Watermelon + BARI Rashun-1 and T\(_5\) = Watermelon + BARI Rashun-2, WEY = Watermelon Equivalent Yield, LER = Land Equivalent Ratio

Table 2: Cost and return analysis of inter-space utilization through garlic production in watermelon field at FSRD site, Hazirhat, Noakhali during Rabi season of 2011-12 and 2012-13

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Watermelon</th>
<th>Garlic</th>
<th>Gross Return (Tk ha(^{-1}))</th>
<th>Total variable cost (Tk ha(^{-1}))</th>
<th>Gross margin (Tk ha(^{-1}))</th>
<th>BCR</th>
</tr>
</thead>
<tbody>
<tr>
<td>T(_1)</td>
<td>34.35</td>
<td>-</td>
<td>274800</td>
<td>80400</td>
<td>194400</td>
<td>3.42</td>
</tr>
<tr>
<td>T(_2)</td>
<td>-</td>
<td>4.85</td>
<td>169750</td>
<td>75500</td>
<td>94250</td>
<td>2.25</td>
</tr>
<tr>
<td>T(_3)</td>
<td>34.29</td>
<td>2.60</td>
<td>365320</td>
<td>104900</td>
<td>260420</td>
<td>3.48</td>
</tr>
<tr>
<td>T(_4)</td>
<td>35.16</td>
<td>2.63</td>
<td>373330</td>
<td>107900</td>
<td>268430</td>
<td>3.56</td>
</tr>
<tr>
<td>T(_5)</td>
<td>36.12</td>
<td>2.82</td>
<td>387660</td>
<td>107900</td>
<td>282760</td>
<td>3.70</td>
</tr>
</tbody>
</table>

T\(_1\) = Sole watermelon (Glory), T\(_2\) = Sole garlic (local), T\(_3\) = Watermelon + Local garlic, T\(_4\) = Watermelon + BARI Rashun-1 and T\(_5\) = Watermelon + BARI Rashun-2, BCR = Benefit Cost Ratio

\(\text{Watermelon selling price: Tk. } 8.00 \text{ kg}^{-1}\) and \(\text{Garlic selling price: Tk. } 35 \text{ kg}^{-1}\)

**Watermelon Equivalent Yield (WEY):** Watermelon equivalent yields in the intercrops were significantly higher than the sole crops. The pooled data showed that watermelon equivalent yield of sole watermelon was higher than the sole garlic. However, Watermelon equivalent yield was maximum in treatment Watermelon + BARI Rashun-2 (48.46 t ha\(^{-1}\)) followed by Watermelon + BARI Rashun-1 (46.67 t ha\(^{-1}\)) and Watermelon + Local garlic (45.67 t ha\(^{-1}\)), respectively. Minimum WEY (34.35 t ha\(^{-1}\)) was recorded in sole watermelon cultivation. The increment of total production by intercropping than sole cropping was also observed in several findings [5-8].

**Land Equivalent Ratio (LER):** The LER is the total area required by sole crop to produce as much as yield can be obtained from an intercropping system. LER value more than one (1.0) indicates a yield advantage of intercropping. All the intercropping treatments showed higher LER than their sole crop cultivation (Table 1). Higher LER was recorded from the treatment Watermelon + BARI Rashun-2 (1.23) followed by Watermelon + BARI Rashun-1 (1.17). Land advantage of crop combination in different treatments ranges from 13% to 23%. LER 1.23 indicates that 23% land utilization advantage over sole cropping. That means the productivity of watermelon could be increased up to 23% in the intercropping of watermelon (Glory) with garlic (BARI Rashun-2). LER value suggests that Watermelon + BARI Rashun-2 had the highest yield advantage which could complementary effect of appropriate plant population of both the crops. Maximum complementary use of different growth resources coupled with the highest LER value of 1.74 was obtained in maize + bush bean intercropping system [9]. Similar results were also observed in chilli + garlic intercropping system with the highest LER value of 1.35 [10].

**Cost Benefit Analysis:** An analysis on cost-benefit of intercropping watermelon with garlic has been given in Table 2. The higher Gross margin (Tk.282760 ha\(^{-1}\)) was obtained from the treatment Watermelon + BARI Rashun-2 which was followed by Watermelon + BARI Rashun-1 (Tk.268430 ha\(^{-1}\)). Watermelon with garlic cultivation also showed higher BCR (3.70, 3.56 and 3.48) over sole watermelon and garlic cultivation (3.42 and 2.25), respectively. This indicated that watermelon intercropped...
with garlic cultivation might be the source of addition income instead of sole watermelon cultivation. Many researchers also documented higher BCR, gross margin or net return in mixed /intercropping system than sole crop [11-13].

**CONCLUSION**

Considering the yield and aforementioned discussion it can be concluded that  Watermelon + BARI Rashun-2  intercropped combination is the most profitable than the other treatments. From above result and discussion it is evident that, intercropping is more profitable than the sole cropping and risk of cultivation of one crop can be reduced by intercropping.

**REFERENCES**


