Role of biocontrol agent for the management of foot and root rot disease of cauliflower

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Abstract

The experiment was conducted at Regional Agricultural Research Station, Ishurdi, Pabna in Bangladesh during 2009-10 to find out the effect of bio control agent against foot and root rot of cauliflower. Five different forms of two biocontrol agents were tested for their performance against the causal pathogen. All the bio control agents showed significantly better performance over control. The lowest foot and root rot incidence (6.25 %) was recorded in soil amendment with *Trichoderma harzianum* compost (1.0 t/ha) treated plots and the highest (18.75 %) was recorded in control. The yield ranged from 17.91 to 23.05 t/ha, the highest and lowest yields were recorded in soil amendment with *Trichoderma harzianum* compost (1.0 t/ha) and untreated control, respectively.

Keywords: *Trichoderma*, foot and root rot and cauliflower

Introduction

Cauliflower (*Brassica oleracea* var. brrytis L.) is one of the most important vegetable crops of Bangladesh in respect of acreage and production. In Bangladesh, the total area under cauliflower cultivation was recorded as 39137 acres with a total production of 156483 metric tons in 2007-2008 (BBS, 2007-2008). Cauliflower is a rich source of vitamin C with a high density of nutrition. Moreover cauliflower has a low fat content, has a high dietary fiber and is rich in folate and water content. Average yield of cauliflower is decreasing due to various diseases, where foot and root rot caused by *Fusarium* spp. and *Sclerotium rolfsii* is the most serious disease (Bakr *et al.* 2010). Foot and root rot of cauliflower may be controlled by chemical treatment. Use of fungicides is being considered as common practice to suppress the activity of pathogen (Agnihotri *et al.* 1975). The use of fungicides to control the disease is not economic because its require repeated application in the field. It is also not always possible to control the infection areas with high inoculam density. Moreover, use of fungicides enhances environmental pollution (Punja, 1985). It has been observed that bio control agent reduced foot and root rot of vegetable crops. In present, biological control of diseases has gained momentum. Biological control of soil borne pathogens offer environmentally safe, durable and most effective alternatives to chemicals (Papavizas

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and Lumsden, 1980). Some authors defined *Trichoderma* strains as plant symbiont and opportunistic avirulent organisms, able to colonize plant roots by mechanisms similar to those of mycorrhizal fungi and to produce compounds that stimulate growth and plant defence mechanisms (Harman et al., 2004). *Trichoderma* spp. is now the most common fungal biological control agents that have been extensively researched and deployed throughout the world. The primary mechanism of antagonism in *Trichoderma* is mycoparasitism. Lytic activity is the key feature responsible for the expression of mycoparasitism against several fungal pathogens (Chet, 1987). *Trichoderma* spp. is also good competitors in soil, and producers of volatile and non-volatile antibiotics to suppress target pathogens (Chet, 1987). Though nutrient uptake has been the focus of much research on the arbuscular mycorrhiza association, there is evidence that arbuscular mycorrhizal fungi also play a role in the suppression of crop pests and diseases, particularly soil-borne fungal diseases (Schonbeck, 1979; Paulitz and Linderman, 1991; Linderman, 1994; Borowicz, 2001). Under these circumstances, the present study was undertaken to find out the effective biocontrol agent against foot and root rot disease of cauliflower.

**Materials and Methods**

The experiment was conducted at the RARS, Ishurdi, Pabna during rabi season of 2009-10. Variety BARI cauliflower 1 (Rupa) was used in this experiment. The seeds were sown on October 12, 2009 and transplanted in the main field on November 12, 2009. The experimental design was Randomized Complete Block Design with three replications. The unit plot size was 2.5m × 1.5m and spacing was 60cm × 40cm. Six treatments were T1 = Soil amendment with *Trichoderma harzianum* compost (1.0 t/ha), T2 = Soil amendment with *Trichoderma viride* compost (1.0 t/ha), T3 = Soil amendment with Arbuscular mycorrhizal fungi (1.0 t/ha), T4 = Spaying with spore suspension of *Trichoderma harzianum* at foot region (1:5), T5 = Spaying with spore suspension of *Trichoderma viride* at foot region (1:5) and T6 = Control. Fertilizers and manures were applied as per recommendation. Irrigation, and other cultural practices were performed as and when necessary. Data were recorded on Foot and root rot (%), Plant height(cm), No of leaf / plant, Length of curd (cm), Diameter of curd (cm), Yield / card(kg) and Yield (t/ha). The recorded data were analyzed statistically to find out the level of significance and the variations among the respective data. Treatment means were compared following Duncan’s New Multiple Range Test (DMRT).

**Results and Discussion**

**Effect of bio control agents in controlling foot and root rot of cauliflower**

The entire bio-control agent significantly reduced the disease as compared to control (Fig. 1). The lowest foot and root rot (6.25%) was recorded in the plots where soil amendment with *Trichoderma harzianum* compost @ 1.0 t/ha (T1) which was statistically similar to T2, T4 and T5 whereas the highest foot and root rot (18.75%) was recorded in control plots (T6). The results were in agreement with the findings of Islam et al. (2007). They observed that *Trichoderma harzianum* colonized organic wastes have posi-
tive effect against foot and root diseases of wheat. Van Steekelenburg (1991) showed that *T. harzianum* reduced the incidence and spread of *Fusarium* crown and root rot in rockwool-grown tomatoes.

**Effect of bio control agents on yield and yield contributing attributes of cauliflower**

All the treatments showed significant effect on yield and yield attributes but didn't show any effect on plant height at harvest (Table 1).

The number of leaves/plant showed significant variation by the application of treatments. The number of leaves per plant was ranged from 21.73-16.73. The maximum number leaves per plant (21.73) was recorded in the plots, where soil amendment with *Trichoderma harzianum* compost (1.0 t/ha) and the lowest was recorded in control plots (T₆) which is statistically similar to T₂, T₃, T₄ and T₅. From the result, it was observed that soil amendment with *Trichoderma harzianum* compost (1.0 t/ha) produced the height number of leaves per plant. The results were in accordance with the results of Rahman *et al.* (2010). They observed that application of *Tricho*-compost+NPK produced the highest number of leaves of chili. The length/curd was significantly (p=0.05) influenced by different treatments. Length per curd was ranged from 11.33-14.55 cm. The highest was recorded in soil amendment with *Trichoderma harzianum* compost (1.0 t/ha) treated plots (T₁) which is statistically similar to T₁, T₃, T₄ and T₅. Treatment T₂ was statistically similar T₃, T₄ and T₅. The diameter per curd was significantly (P=0.01) varied by the application of different treatments. The diameter per curd ranged from 10.89-14.55 cm. The highest was recorded in soil amendment with *Trichoderma harzianum* compost (1.0 t/ha) treated plots (T₁) and the lowest was
recorded in control plots (T₆) which was statistically similar to treatment T₃ and T₄. The treatment T₂ was statistically similar to T₅. Application of different treatments significantly (p=0.01) influenced the yield per curd of cauliflower. The yield/curd ranged from 0.50-0.64 kg, where the highest was recorded in soil amendment with *Trichoderma harzianum* compost (1.0 t/ha) treated plots (T₁) and the lowest was recorded in control plots (T₆) which is statistically similar to treatment T₃ and T₄. The treatment T₂ was statistically similar to T₃, T₄ and T₅. The yield of cauliflower was significantly (p=0.05) influenced by the application of different treatments. The highest yield (23.05 t/ha) was recorded in soil amendment with *Trichoderma harzianum* compost (1.0 t/ha) treated plots (T₁) which is statistically similar to T₂, T₃, T₄ and T₅ and the lowest yield (17.91 t/ha) was recorded in control plots (T₆). The results were agreed with the results of Rahman *et al.* (2010) observing the *Trichicompost* influence of the yield of chili. The results were in also agreement with the findings of Islam *et al.* (2007) in wheat. They observed that highest grain weight and 1000 seed grain weight were recorded in *Trichoderma harzianum* colonizing tea waste amended plot.

**Relationship between foot and root rot incidence and yield of cauliflower**

Correlation and regression coefficients were estimated between foot and root rot incidence and yield of cauliflower (Fig. 2). The regression and correlation between foot and root rot yield and yield of cauliflower was obtained as equation $y = 25.438 - 0.4079x$ and correlation coefficient $r = -0.9122**$. The relationship showed that the yield was strongly negative correlated with foot and root rot incidence under biocontrol agents. The regression lines indicate that with the increase of foot and root rot incidence decreases the yield of cauliflower.

<table>
<thead>
<tr>
<th>Treatments</th>
<th>Plant height (cm)</th>
<th>No of leaves/plant</th>
<th>Length / curd (cm)</th>
<th>Diameter / curd (cm)</th>
<th>Yield / curd (kg)</th>
<th>Yield (t/ha)</th>
</tr>
</thead>
<tbody>
<tr>
<td>T₁</td>
<td>53.33</td>
<td>21.73 a</td>
<td>14.55 a</td>
<td>14.55 a</td>
<td>0.64 a</td>
<td>23.05 a</td>
</tr>
<tr>
<td>T₂</td>
<td>51.73</td>
<td>19.27 b</td>
<td>13.22 bc</td>
<td>13.44 b</td>
<td>0.55 bc</td>
<td>20.79 ab</td>
</tr>
<tr>
<td>T₃</td>
<td>49.87</td>
<td>17.07 b</td>
<td>12.08 cd</td>
<td>11.55 c</td>
<td>0.53 cd</td>
<td>20.18 ab</td>
</tr>
<tr>
<td>T₄</td>
<td>50.47</td>
<td>18.78 b</td>
<td>12.33 b-d</td>
<td>11.83 c</td>
<td>0.53 cd</td>
<td>20.19 ab</td>
</tr>
<tr>
<td>T₅</td>
<td>52.13</td>
<td>18.20 b</td>
<td>13.55 ab</td>
<td>13.52 b</td>
<td>0.59 b</td>
<td>22.46 a</td>
</tr>
<tr>
<td>T₆</td>
<td>48.87</td>
<td>16.73 b</td>
<td>11.33 d</td>
<td>10.89 c</td>
<td>0.50 d</td>
<td>17.91b</td>
</tr>
</tbody>
</table>

**Table 1. Effect of bio control agents on yield and yield attributes of cauliflower**

In a column, similar letter (s) do not differ significantly at 5% (*) and 1% (**) level of probability

NS=Not significant

T₁=Soil amendment with *Trichoderma harzianum* compost (1.0 t/ha), T₂=Soil amendment with *Trichoderma viride* compost (1.0 t/ha, T₃=Soil amendment with Arbuscular mycorrhizal fungi (1.0 t/ha), T₄=Spaying with spore suspension of *Trichoderma harzianum* at foot region (1:5), T₅=Spaying with spore suspension of *Trichoderma viride* at foot region (1:5), T₆=Control

In a column, similar letter (s) do not differ significantly at 1% (**) level of probability

CV (%) 5.88 7.08 5.32 4.25 3.82 8.07

Lsd 5.465 2.398 1.242 0.9763 0.04068 3.047

F-test NS * ** ** ** *
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References


