Influence of Different GA₃ Concentrations on Growth and Yield of Broccoli

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Abstract: An experiment was conducted to find out the influence of GA₃ on growth, yield and yield contributing characters of broccoli (Brassica oleracea var. Italica). Four levels of GA₃ viz. C₁: Control, C₂: 25 ppm GA₃, C₃: 50 ppm GA₃ and C₄: 75 ppm GA₃ was used on the experiment. The maximum plant height (31.5 cm), number of leaves (16.6/plant), number of main fingers (12.0/main curd), main curd length (21.3 cm), main curd diameter (19.3 cm), main curd weight (668.0 g/plant) and yield (24.5 t/ha) was found from the application of 50 ppm GA₃, while the minimum from control. It was revealed that, 50 ppm GA₃ gave maximum yield/ha (24.5 tons). From the study it was also found that application of more than 50 ppm GA₃ reduced the yield of broccoli.

Key words: Broccoli • GA₃ and Yield

INTRODUCTION

Broccoli (Brassica oleracea var. Italica) is an important cole crops belongs to Brassicaceae family closely related to cauliflower. Sprouting broccoli has about 130 times more vitamin A contents then cauliflower and 22 times more than cabbage [1]. However, due to increase in its popularity, there is a trend to increase cultivation by farmers, as well as consumption by consumers. But the main problems are availability of quality seed, low yield and short shelf life. There is an ample scope increase yield of broccoli under Bangladesh conditions and it has a great export potential. In recent years a great deal of research work has been reported on the uses of plant growth regulators in vegetable crops. Growth regulators are organic compounds other than nutrients; small amount which are capable of modifying growth. Plant growth regulators modify the physiological processes within the plant, which ultimately affect the growth, yield and quality of the crop. Among, plant growth regulators, GA₃ exhibited beneficial effect in several cole crops by stimulating cell division or cell enlargement or both [2] and foliar application of different concentrated GA₃ provide more yield [3, 4]. GA₃ have close relation with growth and yield of broccoli and determination of exact concentrations of GA₃ is important for growth and yield broccoli. GA₃ singly influence plant growth and yield of broccoli but the effects of this factor on the growth and yield of broccoli have not been studied in details under Bangladesh conditions. Therefore, to get the highest yield such studies under Bangladesh conditions are needed. The present experiment was undertaken to find out the optimum level of GA₃ and time of application for obtaining higher yield.

MATERIALS AND METHODS

The experiment was conducted at the Horticultural Research Farm of Bangabandhu Sheikh Mujibur Rahman Agricultural University, Gazipur during the period from
October 2, 2012 to January 7, 2013 using Randomized Complete Block Design (RCBD) with three replications. Four levels of GA, viz. C: Control, C: 25 ppm GA, C: 50 ppm GA, and C: 75 ppm GA, was used in the experiment. The unit plot area was 1.5 m x 2.0 m having plot to plot and replication to replication distance of 0.5 and 1.0 m, respectively. There were four rows in each plot having three plants per row and 12 plants were accumulated in each plot. Row to row and plant to plant distance was 50 cm and 50 cm, respectively. Data were collected on plant height, number of leaves per plant, leaf size, canopy spread, stem diameter, plant vigor, days to curd initiation (1<sup>st</sup> and 50%), main curd diameter, main curd length, main curd weight/plant, yield/plant and yield. The collected data on various parameters were statistically analyzed using MSTAT-C program. The means were separated by Duncan’s Multiple Range Test (DMRT) at 5% level of probability [5].

RESULTS AND DISCUSSION

Growth Characteristics

Plant Height: Plant height varied significantly among the treatments. The tallest plant was found from C (31.5 cm) which was statistically identical with C (30.2 cm), while the shortest plant was found from C and C (29.6 cm) (Table 1).

Stem Diameter: The maximum stem diameter was found from C (33.5 cm) which was statistically identical with C (34.1 cm) and C (33.2 cm), while the minimum from C (30.7 cm) (Table 1).

Number of Leaves: Number of leaves was found to be significant variation among the treatments. The maximum number of leaves was found from C (16.6/plant), whereas the minimum from C (14.1/plant) (Table 1).

Table 1: Effect of GA levels on plant height, stem diameter, number of leaves/plant, canopy spreading, first and 50% flower initiation and first harvest

<table>
<thead>
<tr>
<th>GA levels</th>
<th>Plant height (cm)</th>
<th>Stem diameter (cm)</th>
<th>Number of leaves/plant</th>
<th>Canopy spreading (cm)</th>
<th>Days to first flowering</th>
<th>Days to 50% flowering</th>
<th>Days to first harvest</th>
</tr>
</thead>
<tbody>
<tr>
<td>C</td>
<td>30.2 ab</td>
<td>30.7 b</td>
<td>14.1 c</td>
<td>31.3 b</td>
<td>46.6 a</td>
<td>50.3 bc</td>
<td>65.6 a</td>
</tr>
<tr>
<td>C</td>
<td>29.6 b</td>
<td>33.2 a</td>
<td>14.8 b</td>
<td>33.8 a</td>
<td>46.8 a</td>
<td>50.8 ab</td>
<td>65.8 a</td>
</tr>
<tr>
<td>C</td>
<td>31.5 a</td>
<td>33.5 a</td>
<td>16.6 a</td>
<td>34.2 a</td>
<td>46.2 a</td>
<td>49.7 c</td>
<td>65.1 a</td>
</tr>
<tr>
<td>C</td>
<td>29.6 b</td>
<td>34.1 a</td>
<td>14.9 b</td>
<td>34.7 a</td>
<td>46.6 a</td>
<td>51.3 a</td>
<td>65.6 a</td>
</tr>
<tr>
<td>CV (%)</td>
<td>2.4</td>
<td>4.5</td>
<td>3.6</td>
<td>4.5</td>
<td>2.6</td>
<td>2.1</td>
<td>1.8</td>
</tr>
</tbody>
</table>

In a column mean values having similar letter(s) are statistically similar and those having dissimilar letter(s) differ significantly as per 0.05 level of significance

Number of fingers/ main curd: Significant variation was found for number of fingers per the main curd. The maximum number of fingers/main curd was found from C (12.0/main curd) which was statistically identical with C (11.9/main curd), whereas the minimum from C (10.9/main curd) (Table 2).

Table 2: Effect of GA levels on number of fingers/main curd, 50% harvest, number of hollow stem/plot, main curd length, main curd diameter, main curd weight/plant and yield

<table>
<thead>
<tr>
<th>GA levels</th>
<th>Number of fingers/main curd</th>
<th>Days to 50% harvest</th>
<th>Number of hollow stem/plot</th>
<th>Main curd length (cm)</th>
<th>Main curd diameter (cm)</th>
<th>Main curd weight (g)/plant</th>
<th>Yield (t/ha)</th>
</tr>
</thead>
<tbody>
<tr>
<td>C</td>
<td>10.9 c</td>
<td>68.3 bc</td>
<td>8.3 a</td>
<td>11.5 b</td>
<td>15.3 d</td>
<td>381.3 d</td>
<td>18.2 d</td>
</tr>
<tr>
<td>C</td>
<td>11.5 b</td>
<td>68.8 ab</td>
<td>8.2 a</td>
<td>15.6 a</td>
<td>18.5 b</td>
<td>537.3 c</td>
<td>21.1 c</td>
</tr>
<tr>
<td>C</td>
<td>12.0 a</td>
<td>67.6 c</td>
<td>7.3 b</td>
<td>23.1 a</td>
<td>19.3 a</td>
<td>668.0 a</td>
<td>24.5 a</td>
</tr>
<tr>
<td>C</td>
<td>11.9 a</td>
<td>69.3 a</td>
<td>7.2 b</td>
<td>15.5 a</td>
<td>17.4 c</td>
<td>573.5 b</td>
<td>22.9 b</td>
</tr>
<tr>
<td>CV (%)</td>
<td>3.2</td>
<td>1.5</td>
<td>11.6</td>
<td>5.8</td>
<td>2.8</td>
<td>6.3</td>
<td>3.3</td>
</tr>
</tbody>
</table>

In a column mean values having similar letter(s) are statistically similar and those having dissimilar letter(s) differ significantly as per 0.05 level of significance

Canopy Spreading: The maximum canopy spreading was found from C (34.7 cm<sup>2</sup>) which was statistically identical with C (33.8 cm<sup>2</sup>) and C (34.2 cm<sup>2</sup>), whereas the minimum was found from C (31.3 cm<sup>2</sup>) (Table 1).

Days to First Flowering: Days to flowering was found statistically identical among the treatments. However, early flowering was found from C (46.2 days), while late flowering was found from C (46.8 days) (Table 1).

Days to 50% Flowering: Significant variation was found for days to 50% flowering. The maximum 51.3 days was taken by C, while the minimum 49.7 days by C (Table 1).

Days to First Harvest: Significant variation was not found in days to first harvest. The maximum days were taken by C (65.8), while the minimum days were taken by C (65.1) (Table 1).
Main Curd Length: Statistically significant variation was found from the length of main curd. The longest main curd was found from C3 (21.3 cm) which was statistically identical C2 (15.6 cm) and C4 (15.5 cm), whereas shortest main curd was found from C1 (11.5 cm) (Table 2).

Main Curd Diameter: Significant variation was found in main curd diameter among the GA3 levels. The maximum main curd diameter was found from C1 (19.3 cm) followed by C3 (18.5 cm), whereas the minimum from C2 (15.3 cm) (Table 2).

Main Curd Weight: Main curd weight showed significant variation among the GA3 levels. However, the maximum main curd weight was found from C3 (668.0 g/plant) which was followed by C4 (573.5 g/plant), while the minimum was found from C1 (381.3 g/plant) (Table 2).

Yield: Significant variation was observed among the GA3 levels for yield of broccoli. The maximum yield was found from C3 (24.5 t/ha) followed by C4 (22.9 t/ha), whereas the minimum from C1 (18.2 t/ha) (Table 2).

DISCUSSION

Superiority in growth parameters due to foliar application of different concentrated GA3 over control possibly for due to the physiological effects of gibberellins on growth parameters of plants like cell elongation and cell division, increase in photosynthetic activity and better food accumulation. Early head initiation and maturity may be due to the suppressive action of GA3 on apical meristem and interference with gibberellins synthesis. The increase in plant height may be due to the effect of GA3 on the cell division and cell enlargement and also GA3 stimulated the growth and expansion of cells through increasing the wall plasticity of cells [6, 7]. Foliar application increases the shoot system such as plant high, number of leaves, lateral buds, number of branches and number of flowers [8]. Foliar application of GA3 was also increased the growth characteristics in cabbage [9, 10], Knol-khol [11], cherry tomato [12], gerbera [13, 14], gladiolus [15]. The increase in weight of head and yield might be due to accumulation of carbohydrates by more photosynthesis. The another probable reason for increasing yield attributes might be due to the increasing growth characters by cell division, cell elongation and cell expansion that might have ultimately increased in the yield. Increasing trend in yield by the foliar application of GA3 also found in sprouting broccoli [16], cabbage [9, 17, 18], cherry tomato [12] and strawberry [19].

CONCLUSION

Considering quality, yield contributing characters and yield potential of Broccoli, 50 ppm GA3 gave maximum yield while seedling deep in GA3 for 24 hour before transplanting.

REFERENCES