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Influence of Different GA_3 Concentrtions on Growth and Yield of Broccoli

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Abstract: An experiment was conducted to find out the influence of GA_3 on growth, yield and yield contributing characters of broccoli *(Brassica oleracea var. Italica)*. Four levels of GA_3 *viz.* C_1: Control, C_2: 25 ppm GA_3, C_3: 50 ppm GA_3 and C_4: 75 ppm GA_3 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 GA_3, while the minimum from control. It was revealed that, 50 ppm GA_3 gave maximum yield/ha (24.5 tons). From the study it was also found that application of more than 50 ppm GA_3 reduced the yield of broccoli.

Key words: Broccoli · GA_3 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, GA_3 exhibited beneficial effect in several cole crops by stimulating cell division or cell enlargement or both [2] and foliar application of different concentrated GA_3 provide more yield [3, 4]. GA_3 have close relation with growth and yield of broccoli and determination of exact concentrations of GA_3 is important for growth and yield broccoli. GA_3 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 GA_3 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

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October 2, 2012 to January 7, 2013 using Randomized Complete Block Design (RCBD) with three replications. Four levels of GA_3 *viz.* C_1: Control, C_2: 25 ppm GA_3, C_3: 50 ppm GA_3 and C_4: 75 ppm GA_3 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 (1st 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_3 (31.5 cm) which was statistically identical with C_1 (30.2 cm), while the shortest plant was found from C_2 and C_4 (29.6 cm) (Table 1).

Stem Diameter: The maximum stem diameter was found from C_3 (33.5 cm) which was statistically identical with C_4 (34.1 cm) and C_2 (33.2 cm), while the minimum from C_1 (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_3 (16.6/plant), whereas the minimum from C_1 (14.1/plant) (Table 1).

Canopy Spreading: The maximum canopy spreading was found from C_4 (34.7 cm^2) which was statistically identical with C_2 (33.8 cm^2) and C_3 (34.2 cm^2), whereas the minimum was found from C_1 (31.3 cm^2) (Table 1).

Days to First Flowering: Days to flowering was found statistically identical among the treatments. However, early flowering was found from C_3 (46.2 days), while late flowering was found from C_2 (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_4, while the minimum 49.7 days by C_3 (Table 1).

Days to First Harvest: Significant variation was not found in days to first harvest. The maximum days were taken by C_2 (65.8), while the minimum days were taken by C_3 (65.1) (Table 1).

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_3 (12.0/main curd) which was statistically identical with C_4 (11.9/main curd), whereas the minimum from C_1 (10.9/main curd) (Table 2).

Days to 50% Harvest: Days to 50% harvest varied significantly among the treatments. Early 50% harvesting was found from C_3 (67.7 days) while late from C_4 (69.3 days) (Table 2).

Number of Hollow Stem: Significant variation was found from number of hollow stem. The maximum number of hollow stem was found from C_1 (8.3/plot) which was statistically identical with C_2 (8.2/plot), whereas the minimum was found from C_4 (7.2/plot) which was statistically similar C_3 (7.3/plot) (Table 2).

Table 1: Effect of GA_3 levels on plant height, stem diameter, number of leaves/plant, canopy spreading, first and 50% flower initiation and first harvest [x]

GA_3 levels	Plant height (cm)	Stem diameter (cm)	Number of leaves/plant	Canopy spreading (cm^2)	Days to first flowering	Days to 50% flowering	Days to first harvest
C_1	30.2 ab	30.7 b	14.1 c	31.3 b	46.6 a	50.3 bc	65.6 a
C_2	29.6 b	33.2 a	14.8 b	33.8 a	46.8 a	50.8 ab	65.8 a
C_3	31.5 a	33.5 a	16.6 a	34.2 a	46.2 a	49.7 c	65.1 a
C_4	29.6 b	34.1 a	14.9 b	34.7 a	46.6 a	51.3 a	65.6 a
CV (%)	2.4	4.5	3.6	4.5	2.6	2.1	1.8

[x] 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

Table 2: Effect of GA_3 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 [x]

GA_3 levels	Number of fingers/main curd	Days to 50% harvest	Number of hollow stem/plot	Main curd length (cm)	Main curd diameter (cm)	Main curd weight (g)/plant	Yield (t/ha)
C_1	10.9 c	68.3 bc	8.3 a	11.5 b	15.3 d	381.3 d	18.2 d
C_2	11.5 b	68.8 ab	8.2 a	15.6 a	18.5 b	537.3 c	21.1 c
C_3	12.0 a	67.6 c	7.3 b	21.3 a	19.3 a	668.0 a	24.5 a
C_4	11.9 a	69.3 a	7.2 b	15.5 a	17.4 c	573.5 b	22.9 b
CV (%)	3.2	1.5	11.6	5.8	2.8	6.3	3.3

[x] 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

Main Curd Length: Statistically significant variation was found from the length of main curd. The longest main curd was found from C_3 (21.3 cm) which was statistically identical C_2 (15.6 cm) and C_4 (15.5 cm), whereas shortest main curd was found from C_1 (11.5 cm) (Table 2).

Main Curd Diameter: Significant variation was found in main curd diameter among the GA_3 levels. The maximum main curd diameter was found from C_3 (19.3 cm) followed by C_2 (18.5 cm), whereas the minimum from C_1 (15.3 cm) (Table 2).

Main Curd Weight: Main curd weight showed significant variation among the GA_3 levels. However, the maximum main curd weight was found from C_3 (668.0 g/plant) which was followed by C_4 (573.5 g/plant), while the minimum was found from C_1 (381.3 g/plant) (Table 2).

Yield: Significant variation was observed among the GA_3 levels for yield of broccoli. The maximum yield was found from C_3 (24.5 t/ha) followed by C_4 (22.9 t/ha), whereas the minimum from C_1 (18.2 t/ha) (Table 2).

DISCUSSION

Superiority in growth parameters due to foliar application of different concentrated GA_3 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 GA_3 on apical meristem and interference with gibberellins synthesis. The increase in plant height may be due to the effect of GA_3 on the cell division and cell enlargement and also GA_3 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 GA_3 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 GA^3 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 GA_3 gave maximum yield while seedling deep in GA_3 for 24 hour before transplanting.

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