EFFECT OF GA_3 ON GROWTH AND YIELD OF MUSTARD

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ABSTRACT

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An experiment was conducted in pot house at the Bangladesh Institute of Nuclear Agriculture (BINA), Mymensingh during November 2003 to February 2004 to evaluate the effects of Gibberellic Acid (GA_3) on growth, and yield of mustard var. Binasarisha-3. Four concentrations viz., 0, 25, 50 and 75 ppm of GA_3 were sprayed on canopy at 30 days after sowing. The results showed that different levels of GA_3 significantly influenced the plant height, number of fertile siliqua/plant, number of seeds/siliqua, number of flowers/plant, setting of siliqua/plant (%), and harvest index. Results revealed that GA_3 at 50 ppm significantly increased plant height, number of fertile siliqua/plant, number of flowers/plant, setting of siliqua/plant (%), dry matter yield, number of seeds/siliqaua, and harvest index, while the number of flowers/plant was significantly increased with the application of 75 ppm GA_3. The highest seed yield/plant was recorded from the application of 50 ppm GA_3 at optimum harvest date. The seed yield/plant was positively correlated with plant height, number of seeds/siliqua, number of fertile siliqua/plant and % of setting siliqua/plant.

Key wards: GA_3, growth and yield

INTRODUCTION

Mustard is an important oil seed crop of the world after soybean (FAO, 2001). In Bangladesh, it is the leading oil seed crop, covering about 80% of the total oil seed crop area and contributing to more than 71% of the total oil crop production (BBS, 2003). Bangladesh is facing a huge deficit of edible oil. In view of the importance of this crop, attention has to be given to increase its production in order to meet the huge shortage of cooking oil in the country. According to the National Nutrition Council (NNC) of Bangladesh, the Recommended Dietary Allowance (RDA) is estimated to be 6 gm oil/capita/ day for a diet with 2700 Kcal (NNC, 1984). On this RDA basis, Bangladesh requires 0.29 million tons of oil equivalent to 0.8 million tons of oil seeds for nourishing her people.

At present, the indigenous oil seed production is about 0.25 million tons which can cover only 40% of the domestic need (FAO, 2001). If we are able to increase yield of mustard, it will mitigate the oil deficiency of our country. Gibberellic acid ($GA_{3)}$ is a phytohormone that is needed in small quantities at low concentration to accelerate plant growth and development. So, favorable condition may be induced by applying growth regulator exogenously in proper concentration at a proper time in a specific crop by GA_3. Gibberellic acid is such a plant growth regulator, which can manipulate a variety of growth and development phenomena in various crops. GA_3 enhances growth activities to plant, stimulates stem elongation (Deotale *et al.*, 1998, Abd, 1997; Lee, 1990), and increases dry weight and yield (Deotale *et al.*, 1998 and Maske *et al.*, 1998). Therefore, the present research work was undertaken to evaluate the effect of various concentrations of GA3 on growth and yield of mustard.

MATERIALS AND METHODS

The experiment was conducted in pot house at the Bangladesh Institute of Nuclear Agriculture, Mymensingh, during November 2003 to February 2004 to evaluate the effects of GA_3 on growth and yield of mustard var. Binasarisha-3. The experiment comprised of four levels of GA_3 viz., 0, 25, 50 and 75 ppm. These concentrations of GA_3 were sprayed on canopy at one time as foliar spray method at 30 days after sowing.The experiment was laid out in Completely Randomized Design (CRD) with four replications. The soil was collected from BINA farm area, Mymensingh and dried for several days. Clods were broken and weeds and stubbles were removed. The collected soil belongs to the Sonatola series of Grey Flood Plain under the Old Brahmaputra Agro-Ecological Zone (UNDP and FAO, 1988). As per requirement of the experiment, pot preparation, lay out, fertilization, sowing of seeds, pest management and other intercultural operations including foliar application of GA_3, harvesting and data collection were done carefully. Data were collected on plant height (cm), number of flowers/plant, percentage of setting of siliqua /plant , number of fertile siliqua/plant, number of seeds/siliqua , total dry matter/ plant (gm), harvest index (%) and seed yield / plant at optimum harvest date. The collected data were statistically analyzed using MSTAT-C package program.

RESULTS AND DISCUSSION

Plant height

Different concentrations of GA_3 had significantly influenced the plant height. Plant height was the highest (95.77 cm) with the application of 50 ppm GA_3 which was statistically similar with 75 ppm GA_3 and the lowest (77.63 cm) was found in the control (Table 1). Significant increase in plant height induced by different levels of GA_3 was observed in rapes (Castro *et. al.*, 1989). A gradual increase in plant height was noticed up to 50 ppm. Further increase in concentration (75 ppm GA_3) had resulted in reduced plant height.

Number of flowers/plant

The application of different concentrations of GA_3 had significantly influenced the number of flowers/plant. The highest number of flowers/plant (336.00) was found with the application of 75 ppm of GA_3 (Table 1). The lowest number of flowers / plant (202.67) was produced in the control.

Setting of siliqua/plant (%)

The application of different levels of GA_3 influenced the setting of siliqua/plant. The highest setting of siliqua/plant (74.96%) was observed with the application of 50 ppm GA_3 and the lowest setting of siliqua/plant (55.92%) was found under control treatment (Table1). The percentage of setting of siliqua was increased with the increased level of GA_3 up to 50 ppm. But further increase in the concentration of GA_3 decreased the percentage of setting of siliqua/plant.

Number of fertile siliqua/plant

The application of different concentrations of GA_3 had influenced the number of fertile siliqua/plant significantly. The highest number of fertile siliqua/plant (244.00) was obtained from 50 ppm GA_3 and the lowest number of fertile siliqua (152) was recorded in the control (Table1). Results indicated that 50 ppm GA_3 was the optimum dose for producing the highest number of fertile siliqua/plant. The result of the present study is similar to the findings of Khan *et al.* (1998) who observed that application of GA_3 at 80 days after sowing on *Brassica juncea* had increased the number of siliqua/plant. GA_3 might have increased the translocation of assimilates to the reproductive organ which resulted in the maximum number of fertile siliqua/plant up to certain levels of GA_3 application (Uddin *et al.*, 1986; Kandil, 1983).

Number of seeds/siliqua

Number of seeds/siliqua was significantly influenced by different levels of GA_3. The highest number of seeds/siliqua (30.00) was obtained from 50 ppm GA_3 which was statistically identical with 25 and 75 ppm GA_3 and the lowest number of seeds (22.33) was recorded from the untreated control (Table 1). The plant growth regulators like GA_3 might be involved in formation of seeds in the pods and their optimum nourishments have resulted in less number of aborted seeds and thus maximized the survival of fertile seeds/pod in rapes and mustard (Inanaga and Kumura, 1987; Holmberg and German, 1991; Boultior and Morgan, 1992).

Total dry matter/plant

A significant variation was found in terms of total dry matter due to the application of different levels of GA_3 (Table 1). Among the levels of GA_3, the highest total dry matter was found with 50 ppm GA_3 (33.68 g) and the lowest total dry matter was obtained from the untreated control (25.09 g). Application of 10^{-5} M of GA3 on mustard at 40 or 60 days after sowing significantly increased total dry matter (Khan *et al.*, 1998). Khan *et al.* (2002) observed an increase in total dry matter in *Brassica juncea* with the application of 10^{-5} M GA_3.

Harvest index (HI)

The results showed that different concentrations of GA_3 had significant influence on the harvest index (Table1). The highest harvest index (38.50%) was observed from 50 ppm GA_3 which was statistically identical with 25 ppm and the lowest harvest index (32.96%) was obtained in control. The higher harvest index indicated that GA_3 application accelerated assimilate supply to sink, which is in agreement with the results of Gouping and Etmal (1992). GA_3 at 0-75 mg/L applied at 600 liters/ha at the pre flowering stage on Indian mustard (*Brassica Juncea*) was reported to increase the harvest index (Khan, 1997).

Seed yield/plant

Different levels of GA_3 had significant effect on seed yield/plant (Table 1). The application of 50 ppm GA_3 produced the highest seed yield/plant (13.13 g). While, the control plant produced the lowest seed yield/plant (8.27 g). The application of 50 ppm of GA_3 was more effective to reduce yield loss due to siliqua shattering. Khan *et al.* (2002) in a field trial with GA_3 at 0, 10^{-4}, 10^{-5} and 10^{-6} M observed an increased seed yield of

Brassica juncea. Hayat *et al*. (2001) conducted an experiment with GA_3 at 10^{-6} M on 30 days old plants in mustard and observed that GA_3 increased vegetative growth and seed yield at harvest.

It was found that seed yield per plant had significant positive correlation with yield contributing character's like plant height, number of seeds per siliqua, number of fertile siliqua per plant, percent sets of siliqua per plant (Fig. 1-4). Result of the experimental indicated that the application of 50 ppm GA_3 had positive impact on growth and yield of mustard. The yield loss had been reduced to 17.7% by the application of 50 ppm GA_3. So, the application of 50 ppm GA_3 seems to have the possibility to increase the yield of mustard.

Table1. Effect of different levels of GA3 on some morphological, yield and yield contributing characters of mustard var. Binasarisha -3

Levels of GA_3 (ppm)	Plant height (cm)	No. of flowers /plant	Setting(%) of siliqua/ plant	No. of fertile siliqua /plant	No. of seeds /siliqua	Total dry matter (g)	Harvest index (%)	Seed yield /plant (g)
0	77.60c	202.66d	55.92d	152.00c	22.33b	25.09d	32.46c	8.27c
25	85.20bc	257.00c	63.38c	182.00bc	26.33ab	29.81b	38.10a	10.16b
50	95.77a	298.00b	74.96a	244.00a	30.32a	33.68a	38.50a	13.13a
75	88.30ab	336.00a	70.60b	222.00ab	27.33a	28.54c	35.66b	12.10ab

In a column figures having same letter (s) do not differ significantly at $p < 0.05$ by DMRT,

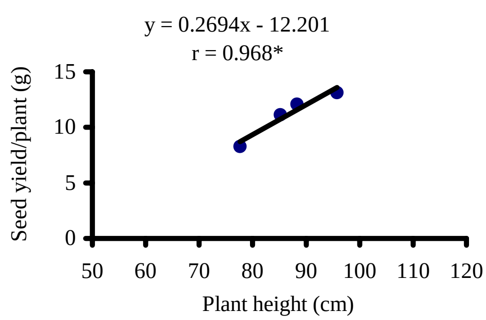

Figure 1. Correlation between seed yield and plant height of mustard var. Binasarisha-3

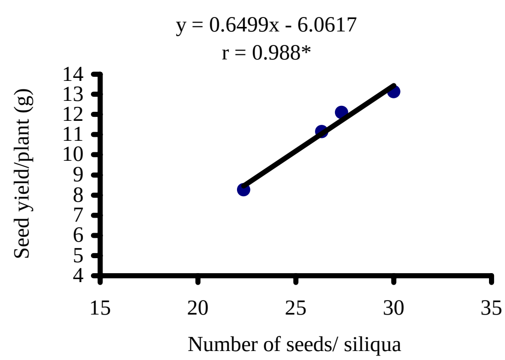

Figure 2. Correlation between seed yield and number of seed/siliqua of mustard var. Binasarisha-3

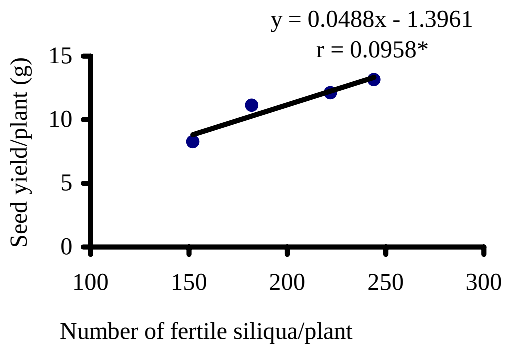

Figure 3. Correlation between seed yield and number of fertile siliqua/plant of mustard var. Binasarisha-3

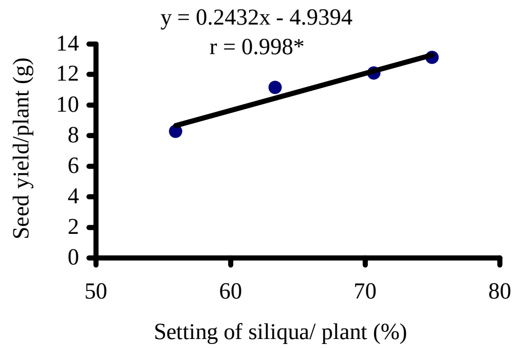

Figure 4. Correlation between seed yield and setting of siliqua/plant (%) of mustard var.Binasarisha-3

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