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Effect of Indoleacetic Acid (IAA) on Yield of Mungbean (*Vigna radiata* L.)

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Abstract: The effect of foliar application with 300, 600 and 900 ppm IAA was investigated on yield and yield contributing characters of two varieties of mungbean (BARI 2 and BARI 4). IAA at 600 ppm significantly increased the number of seeds/plant, seed yield plant^{-1}, seed yield (t ha^{-1}) and 1000-seeds weight. The variety BARI 4 manifested better performance than BARI 2. BARI 4 plants treated with 600 ppm of IAA had the highest pod length, number of seeds, seed yield/plant and seed yield (t ha^{-1}). So, the plants treated with IAA at 600 ppm performed better than those of control and other treatments.

Key words: Effect, indoleacetic acid, yield, mungbean, *Vigna radiata* L.

Introduction

Mungbean (*Vigna radiata* L.) is an important pulse crop and considered as fifth major pulse of Bangladesh. In Bangladesh, its contribution is only 5% to the total pulse production (Anonymous, 1992). Many factors are responsible for low yield, among which climatic factors play an important role in successful cultivation of mungbean. Major climatic factors affecting adaptation of mungbean are photoperiod, temperature, precipitation and solar radiation. Wind and hail storm may cause severe damage to this crop. High humidity sometimes causes development of foliar diseases. Mungbean is normally grown in the summer season, which grows within a mean temperature range of about 20-40°C. Seed yield is drastically reduced beyond 30°C. Warm temperature is essential for rapid germination of mungbean seeds. Studies at AVRDC indicated that 29-31°C temperature is the optimum temperature for better germination. Rate of germination declined slowly below 25°C and virtually ceased below 11.5°C (Simon *et al.*, 1976). Mungbean does not grow well where annual precipitation is above 1,000 mm. Mungbean cannot withstand waterlogged conditions (Jain and Mehra, 1980). It has a reputation for drought tolerance. The crop has received very little attention of the researchers in comparison with other cereals and grain crops. Considering the significance of mungbean in the Bangladesh context, it is therefore, of utmost necessity to improve this pulse both in terms of its quantitative and qualitative values. Various practices may help to achieve this goal. Application of growth regulators seems to be the most significant. Indole acetic acid (IAA) is one of such plant growth regulators, which can manipulate a variety of growth and developmental phenomena in various crops. A foliar application of IAA has been found to increase fruit size with consequent enhancement in seed yield in different crops like groundnut (Lee, 1990), cotton (Kapgate *et al.*, 1989), cowpea (Khalil and Mandurah, 1989), bottle gourd (Gaur and Joshi, 1966) and rice (Kaur and Singh, 1987). Very limited work has been carried out regarding the use of growth regulators especially in mungbean in our country. Although studies, in other countries of the world provided useful information, those may not be applicable directly to our cultivars because of varied weather and soil conditions. Studies on the effect of growth regulators in our climatic conditions could provide useful information in the improvement of yield of mungbean. Considering the above back ground the present work was designed to study the effect of IAA on yield components and yield of two mungbean cultivars.

Materials and Methods

The present experiment was conducted at the Experimental Field of the Department of Crop Botany, Bangladesh Agricultural University Mymensingh, in kharif season during the period from October to December, 2000. The whole experimental land was divided into three blocks maintaining 0.5 m space between two blocks and each block was divided into eight plots maintaining 0.25 m space between them. The site of unit plot was 2.5 x 1 m^2. The plots were spaded one day before planting and the basal dose of fertilizers were incorporated thoroughly before planting. Urea, triple super phosphate (TSP) and muriate of potash (MP) were applied at the rate of 45, 100 and 58 kg ha^{-1}, respectively. Total amount of TSP, MP and urea were applied uniformly at the time of final land preparation. Two varieties of mungbean BARI 2 and BARI 4 were used. The seeds were sown in rows. The distance between rows and seeds were 30 and 15 cm, respectively and two seeds were placed in each point at a depth of 15 cm from the soil surface. Indoleacetic acid, 300 (c_1), 600 (c_2) and 900 ppm (c_3) was used as spray at 20 (DAS). Control (c_o) was also maintained. Total number of seeds per plant, length of the pod, weight of 1000 seeds, seed yield plant^{-1} and yield ha^{-1} were recorded at the final harvest only.

The concentration of IAA was considered as factor A and two varieties as factor B. The experiment was laid out in randomized complete block design (RCBD). There were three replications. Each treatment was randomly accommodated once in each block. The data collected were analyzed using MSTAT. The difference between pairs of means was compared by least significant difference (LSD) and Duncan's multiple range test (DMRT).

Results and Discussion

The effect of IAA on pod length has been presented (Table 1). The longest pod (5.6-cm) was obtained with 600 ppm of IAA and the shortest pod (5.18 cm) was produced by 900 ppm of IAA. However, the variation was insignificant. There was no variation in pod length of the two varieties (Table 2). Saha *et al.* (1996) reported that 300, 600 and 900 ppm IAA applied at the beginning of the tillering stage in wheat increased ear, spikelet and grain length. The interaction effect of varieties and different concentrations of IAA was also found to be statistically insignificant.

Number of seeds per pod is an important yield contributing character. The data on the number of seeds per pod indicated that 600 ppm of IAA (C_2) had superiority over the other treatments and the control (Table 1). IAA applied at 50 % flowering stage to chickpeas grown in Indian Punjab increased the number of seeds pod^{-1} (Arora *et al.*, 1988). IAA at 900 ppm was the least effective treatment. The results of this study indicate that there is no difference in the number of seeds per pod between the varieties (Table 2). The interaction effect between different varieties and different concentrations of IAA was found to be statistically significant at 5% level (Table 3). The highest number of seeds per pod (12.57) was obtained at 600 ppm of IAA x V_1 (C_2 x V_1) and the lowest number of seeds per pod (7.73) was observed with 900 ppm of IAA x V_2 (C_3 x V_2) (Table 3).

Table 1: Yield and yield contributing characters of mungbean as influenced by IAA

Concentration	Number of seeds pod^{-1}	Seed yield $plant^{-1}$ (g)	1000 seeds weight (g)	Pod length pod^{-1} (cm)	Seed yield (t ha^{-1})
Control (C_o)	9.01c	5.99ab	26.98	5.48	1.10b
300 ppm (C_1)	10.40b	6.39ab	28.39	5.53	1.19a
600 ppm (C_2)	12.45a	6.67a	29.23	5.61	1.20a
900 ppm (C_3)	7.82d	5.89b	26.16	5.18	1.04b
Level of sig.	1%	5%	NS	NS	5%
$S_{\bar{x}}$	0.26	0.23	0.27	0.43	0.08
CV%	3.44	7.83	3.41	19.33	5.28

Table 2: Comparative Yield and yield contributing characters of two cultivars of mungbean at final harvest (65 DAS)

Varieties	Pod length pod^{-1} (g)	Number of seeds pod^{-1}	Seed yield $plant^{-1}$ (g)	Seed yield (t ha^{-1})	1000-seeds wt. (g)
BARI 4 (V_1)	5.54	10.02	6.68a	1.28a	28.12
BARI 2 (V_2)	5.37	9.81	5.79b	0.99b	27.51
Level of sig.	NS	NS	1	1	NS
$S_{\bar{x}}$	0.30	0.18	0.16	0.05	0.19
CV%	19.33	3.44	7.83	5.28	3.41

Table 3: Combined effect of IAA and cultivars on Yield and yield contributing characters of mungbean

Cx V	Number of seeds pod^{-1}	Seed yield $plant^{-1}$ (g)	1000-seeds weight (g)	Pod length pod^{-1} (g)	Seed yield (t ha^{-1})
C_0x V_1	9.21c	6.24bc	17.22	5.55	1.23ab
C_1x V_1	10.40b	6.91ab	18.76	5.61	1.32a
C_2x V_1	12.57a	7.40a	26.46	5.63	1.34a
C_3x V_1	7.91d	6.17bc	26.50	5.35	1.20abc
C_0x V_2	8.81c	5.80c	26.75	5.41	0.96bc
C_1x V_2	10.40b	5.87bc	28.02	5.45	1.10abc
C_2x V_2	12.33a	5.94bc	29.00	5.59	1.10abc
C_3x V_2	7.73d	5.61c	25.80	5.01	0.87c
Level of sig.	5%	5%	NS	NS	5%
$S_{\bar{x}}$	0.37	0.31	0.39	0.61	0.11
CV%	3.44	7.83	3.41	19.33	5.28

Figures followed by different letter(s) within a column differ significantly (DMRT) V_1= BARI 4, V_2= BARI 2 C_0= Control
C_1= 300 ppm IAA, C_2 = 600 ppm IAA, C_3 = 900 ppm IAA CV= Coefficient of variance NS= Not significant $S_{\bar{x}}$ = Standard Deviation

Abdul *et al.* (1996) noted that the number of seeds per flax pod was increased by 10^{-5} M IAA. In present study, IAA treated plants had higher number of seeds per pod compared with the control plants.

Results of the present study show that growth regulator application had no influence on 1000-seeds weight in mungbean (Table 1). No significant variation was found in 1000-seeds weight between the varieties (Table 2). The results of the interaction effect of varieties and different concentrations of growth regulator was also insignificant. But according to literatures, foliar application of IAA increase 1000 seeds weight (Rahman and Mian, 1988, Saha *et al.*, 1996, Yan *et al.*, 1995 and Gurdev and Saxena, 1991).

The analysis of variance showed that growth regulator exerted highly significant (5 % level) influence on seed yield per plant (Table 1). IAA obtained the highest seed yield per plant (6.67 g) at 600 ppm and the lowest seed yield per plant (5.89 g) was observed with IAA at 900 ppm. Similar result was obtained by Rahman and Mian (1988) in grass pea, Saha *et al.* (1996) in wheat, Singh *et al.* (1984) and Thakre (1985) in rice.

The varietal difference in seed yield per plant was significant at 1% level (Table 2). V_1 (BARI 4) yielded higher amount of seeds per plant than V_2 (BARI 2).

The results of the interaction effects of varieties and different concentrations of IAA were found statistically significant at 5% level (Table 3). The highest seed yield $plant^{-1}$ (7.4 g) was obtained by 600 ppm IAA x V_1 (C_2 x V_1) and the lowest seed yield/plant (5.61 g) was observed in the treatment combination of 900 ppm IAA x V_2 (C_3 x V_2).

After final harvest, yield was calculated in tones per hectare. The data revealed that IAA had significant influence on seed yield. The highest seed yield (1.20 t ha^{-1}) was obtained when 600 ppm IAA was applied while the lowest seed yield (1.04 t/ha) was observed with 900 ppm IAA (Table 1).

The average yield of the varieties differs significantly at 1% level (Table 2). The highest seed yield (1.28 t ha^{-1}) was obtained by V_1 (BARI 4) and the lowest seed yield (0.99 t ha^{-1}) was observed with V_2 (BARI 2).

The interaction effect of varieties and different concentrations of IAA was found statistically significant at 5% level (Table 3). The highest seed yield (1.34 t ha^{-1}) was obtained by 600 ppm of IAA x V_1 (C_2 x V_1) and the lowest seed yield (0.87 t ha^{-1}) was observed in the interaction between 900 ppm of IAA x V_2 (C_3 x V_2).

The results of the present study are in agreement with those of Awan and Alizai (1989), Sontakey *et al.* (1991) and Reena *et al.* (1999) who reported that 100 ppm IAA increased seed yield in rice, sesame and soybean, respectively.

Application of IAA had significant effect on yield of mungbean. IAA @ 600 ppm produced highest pod length, number of seeds pod^{-1}, seed yield $plant^{-1}$, 1000 seeds weight and seed yield t ha^{-1} and as compared to other concentrations and control. Variety BARI 4 produced higher number of seeds pod^{-1}, 1000 seed weight, seed yield $plant^{-1}$, seed yield (t ha^{-1}) and pod length. Interaction effect of C_2x V_1 (600 ppm IAAx V_1) was promotive in pod length. Further studies are necessary before making conclusion and recommendation.

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