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Effect of growth regulator on morphological attributes of mungbean under irrigated and nonirrigated conditions

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Abstract: This study was conducted with mungbean (*Vigna radiata* L.) during the period from February to May, 2007 to investigate the effect of two levels of irrigation (Irrigated and non-irrigated) and five concentrations of growth regulator (0, 50, 100, 150 and 200 ppm NAA) on morphological parameters viz., plant height, root length, number of branches plant^{-1}, number of leaves plant^{-1}. Irrigation showed significant effect on all these parameters except some genetically regulated characters. Among the concentrations of growth regulator, 200 ppm NAA showed remarkable results on almost all these parameters. The interactions between irrigation and PGR showed better performance in most cases. The results revealed that NAA might be used under irrigated condition for better performance on morphological characters of mungbean.
Key words: Growth regulator, Morphological attributes, Mungbean, Irrigation.

Introduction

Mungbean [*Vigna radiata* (L.) Wilczek] also called green gram, golden gram, mung, mug, is an important pulse crop in the world, because it produces high quality and quantity protein (Tomooka *et al*., 2002). In Bangladesh it is also called "Sonamung" due to its golden colour and high market price. About 22.26 thousand hectares of land was under cultivation and its production was 17 thousand tons (BBS, 2006). Mungbean is used as whole or split seed as Dal (soup) in home and restaurant, and fried Dal in agro-industries but in Southeast and East Asia, mungbean is used to make various kinds of sweets, bean jam, sweetened bean soup, vermicelli and bean sprouts. The grain contains carbohydrate (51%), protein (26%), moisture (10%), mineral (3-4%) and vitamins (3%) (Afzal *et al*., 1998). Besides providing valuable protein in the diet, it helps to fix atmospheric nitrogen to the root rhizobia and enrich the soil (BINA, 2004). The yield of mungbean plant $^{-1}$ as well as unit area^{-1} is very low. Average yield as low as 560 kg ha^{-1} (BBS, 2005) but its production needs to be increased even more than three folds (BARI, 2000). That is why, increasing yield of mungbean by proper management practices need urgent attention.

Plant growth regulators are used to change the morphological characters in many crops. Growth regulator NAA (Naphthalene acetic acid) may influence on the factors, which are accelerating the morphological characters of mungbean. Yield characters are positively or negatively related with morphological characters. There are scopes for improving yield through changing the morphological characters by using plant growth regulators (PGRs) and manipulation of different management practices like irrigation. Recently, there has been global realization of the important role of PGRs in agriculture for better growth and yield of crop. Many developed countries like Japan, China, Poland and South Korea etc, have long been using PGRs for improving crop yield. A large number of research works with NAA has been carried out in many crops all over the world. But research work with NAA on changing the morphological characters of mungbean under irrigated and non-irrigated condition is first time in Bangladesh. Considering the above views the present study was undertaken with the following objectives: a) to study the individual and interaction effects of plant growth regulators (NAA) and irrigation on morphological characters in mungbean; and b) to find out the suitable concentration, and combination of NAA and irrigation for best performance on growth of mungbean.

Materials and Methods

The experiment was conducted at the field laboratory of the Department of Crop Botany, Bangladesh Agricultural University, Mymensingh, during the period from February to May 2007. The experiment comprised of two factors with 2 different irrigation levels viz., I_0 (Control, no irrigation), I_1 (Irrigation was applied once, at 22 DAS) and 5 concentrations of NAA viz., 0 ppm (control), 50 ppm, 100 ppm, 150 ppm and 200 ppm. The cultivar of mungbean, BINAmoog-5 used in this experiment, was collected from Bangladesh Institute of Nuclear Agriculture (BINA), NAA (Naphthalene acetic acid) was collected from Prof. Dr. M.A. Karim, Department of Crop Botany, Bangladesh Agricultural University, Mymensingh. The experiment was laid in a Randomized Complete Block Design (RCBD) with three replications. The size of unit plot was 2m² (2m× 1m). The plot to plot distance was 0.5m and block to block distance was 0.5m. The plots were raised up to 15 cm from the soil surface. The seeds of mungbean were hand sown at 3 cm depth at a spacing of 30 cm × 20 cm. The experimental area was fertilized at a rate of 35 kg urea ha^{-1}, 75 kg TSP ha^{-1}, 40 kg MP ha^{-1} (BINA, 2006). Intercultural operations like weeding, thinning, gap filling and pesticides were applied as and when required. Five plants from central guarded rows were uprooted randomly from each plot starting from 30 DAS and continued till maturity on 80 DAS with interval of 10 DAS and dug carefully for collecting data on important morphological parameters such as plant height, root length, number of branch plant^{-1} and number of leaves plant^{-1}.

All the collected data were analyzed following the analysis of variance (ANOVA) technique and mean

difference were adjudged by DMRT (Duncan's Multiple Range Test) using MSTAT-C (Russell, 1986).

Results and Discussion

The results of the study obtained on how many changes took place in morphological attributes of mungbean due to different concentrations of NAA under irrigated and no irrigated conditions.

Effect of irrigation on the morphological characters of mungbean

Irrigation significantly influenced the plant height ($p \leq 0.05$) at all growth stages Fig. 1(a). Result showed that the plant height increased rapidly up to 70 DAS and thereafter increased slowly. The higher plant height was recorded in irrigated condition (Plate 1&2) than non-irrigated condition (Plate 3&4).

Plate 1. Changes occurred in morphological attributes with foliar spray of 200 ppm NAA under irrigated condition (I_1N_4)

Plate 2. Morphological attributes at control under irrigated condition (I_1N_0)

Root length was significantly influenced by the application of irrigation on mungbean Fig. 1(b). Results revealed that root length increased with the advancement of time. The results further revealed that irrigated plants show the longer root than non-irrigated ones.

Plate 3. Changes occurred in morphological attributes with foliar spray of 200 ppm NAA under non-irrigated condition (I_0N_4)

Plate 4. Morphological attributes at control under non-irrigated condition (I_0N_0)

The effect of irrigation had significant influence on number of branches plant^{-1} Fig. 1(c). Result revealed that branch number increased from 40 DAS to 80 DAS. The higher branch number plant^{-1} was observed in irrigated (Plate 1&2) plant than non-irrigated ones (Plate 3&4). Similar result was observed by Alam (2002) and Huda (2001).

The irrigation had significant effect on number of leaves plant^{-1} in mungbean Fig. 1(d). Result revealed that number of leaves plant^{-1} increased up to 70 DAS followed by plunged because of might be due to leaf shedding. The result also revealed that number of leaves plant^{-1} was significantly greater in irrigated (Plate 1&2) than non-irrigated (Plate 3&4) plants.

Effect of different concentrations of NAA on the morphological characters of mungbean

Different concentrations of NAA significantly increased the plant height of mungbean ($p \leq 0.05$) at all growth stages Fig. 2(e). Plant height increased with increased concentration of NAA. The highest plant height was recorded in 200 mg L^{-1} at all growth stages (Plate 1&3). In contrast, control plants were the shortest (Plate 2&4).

Root length was significantly influenced by the application of different concentrations of NAA on mungbean Fig. 2(f). The results revealed that root

growth increased with increasing concentration of NAA at all growth stages. The longest root length was found in 200 ppm NAA through the growth period followed by 150 ppm with same statistical rank. In contrast, control plants maintained the shortest root length throughout the growth period.

The effect of different concentrations of NAA application had significant influence on number of leaves plant^{-1} Fig. 2(g). Result indicates that number of leaves increased numerically with increasing concentration. The highest number of leaves was observed in 200 ppm (Plate 1&3) and the lowest in control (Plate 2&4). Similarly Chakma (2005) found better performance on morphological parameters in higher concentration of NAA.

The effect of different concentrations of NAA had significant influence on number of branches plant^{-1} Fig. 2(h). Result revealed that branch number was significantly greater in NAA applied plants than those in control. The highest number of branch plant^{-1} was observed in 200 ppm (Plate 1&3) in most of the stages and the lowest in control (Plate 2&4).

Interaction effect between irrigation and different concentrations of NAA on the morphological characters of mungbean

The interaction between irrigation and different concentrations of NAA on plant height and root length were statistically significant (Table 1). Both plant height and root length were maximum in irrigation×200 ppm NAA (I_1N_4) (Plate 1) and the lowest plant height and root length were found in control under non-irrigated condition (I_0N_0) (Plate 4).

The interactions between irrigation and different concentrations of NAA on number of leaves as well as number of branches plant-1 were statistically significant (Table 1). The maximum number of leaves and branches plant^{-1} were observed in irrigation × 200 ppm of NAA (I_1N_4) (Plate 1) and minimum were in non-irrigated control (I_0N_0) plants (Plate 4).

Results revealed that levels of irrigation had greater influence on morphological character viz. plant height, root length, number of branch plant^{-1} and number of leaves plant^{-1}. The highest value of the above parameters was found in irrigated plants than non irrigated ones. Results further revealed that application of NAA had a profound influence upon the above parameters. Results revealed that the above parameters were increased with increasing concentration of NAA. The maximum values of those parameters were recorded in 200 ppm of NAA. In contrast, the minimum values were observed in control. Henceforth application of irrigation and 200 ppm NAA can be suggested for better performance of morphological attributes on mungbean.

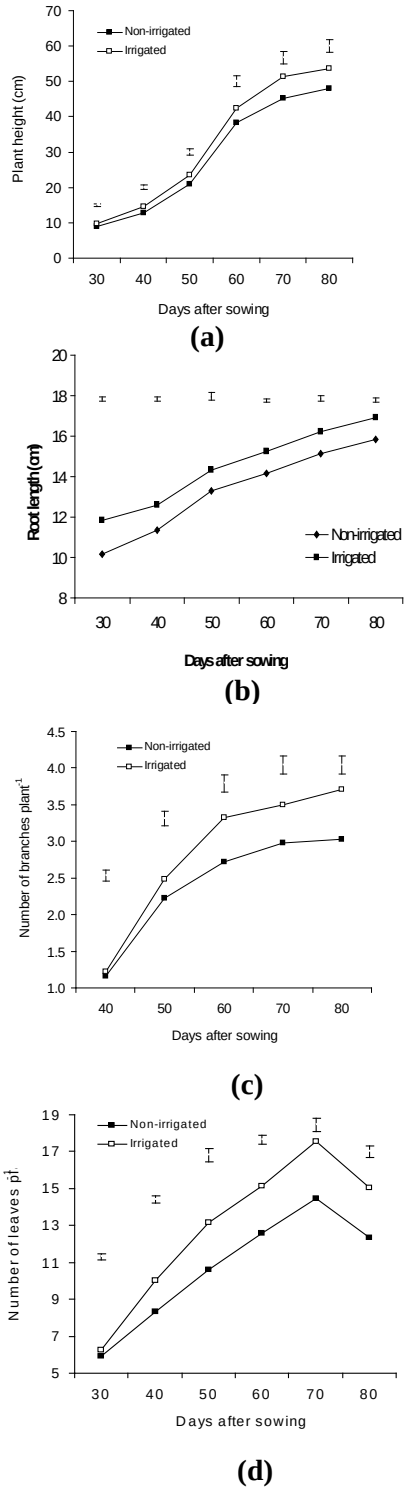

Fig. 1. Effect of irrigation on plant height (a), root length (b), number of branch plant^{-1} (c) and number of leaves plant^{-1} (d). Vertical bars represent LSD$_{(0.05)}$

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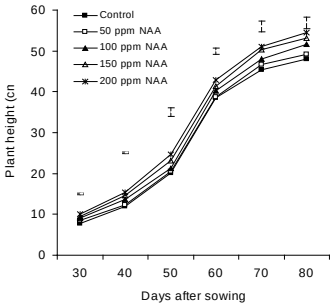

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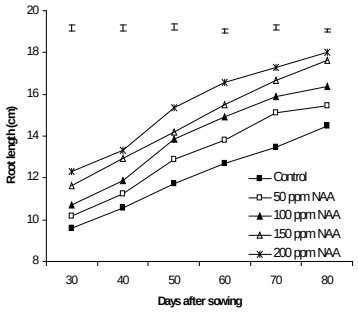

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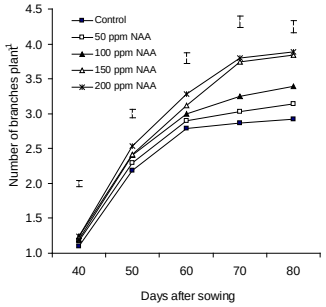

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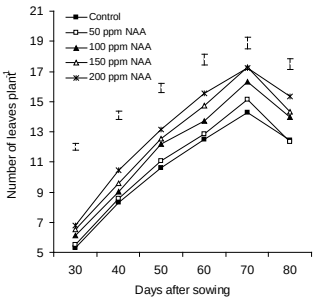

(h)

Fig. 2. Effect of different concentration of NAA application on plant height (e), root length (f), number of branch plant^{-1} (g) and number of leaves plant^{-1} (h). Vertical bars represent $LSD_{(0.05)}$

Table 1. Interaction effect of irrigation and different concentrations of NAA on morphological characters of mungbean

Treatment combina-tions	Plant height (cm)	Root length (cm)	No. of branches plant-1	No. of leaves plant-1
I_0N_0	43.88h	14.54e	2.68g	11.67f
I_0N_1	46.04g	14.66e	2.78g	10.83g
I_0N_2	49.63f	15.87d	3.00f	12.16ef
I_0N_3	51.63de	16.96b	3.30d	12.75de
I_0N_4	51.58de	17.17b	3.40cd	14.25b
I_1N_0	51.04e	14.38e	3.16e	13.25cd
I_1N_1	52.46d	16.29cd	3.50c	13.83bc
I_1N_2	53.79c	16.88bc	3.77b	15.75a
I_1N_3	54.83b	18.29a	4.08a	15.92a
I_1N_4	56.38a	18.88a	4.08a	16.42a
Level of significance	**	**	**	**
CV(%)	0.76	2.10	1.63	2.13

In a column figures having the same letter(s) do not differ significantly at $p \leq 0.05$ by DMRT; ** = Significant at 1% level of probability; I_0 = Non-irrigated, I_1 = Irrigated; N_0 = Control, N_1 = 50 ppm, N_2 = 100 ppm, N_3 = 150 ppm, N_4 = 200 ppm NAA

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