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Effect of Foliar Application of Miyobi Growth Regulators on Morpho-Physiological Attributes and Yield in Chili

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Abstract
Miyobi solution sprayed on chili plants at 30 days after transplanting. Application of Miyobi increased plant height, branch and leaf number, root length, root number, root weight, stem weight, total dry matter, chlorophyll content and photosynthesis in leaves, fruits plant^{-1} and fruit yield over control. Reverse trend was also observed in fruit size. Most of the morphological, biochemical, yield attributes were increased with increasing Miyobi concentration up to 0.8 mgL^{-1} followed by a decline. These results indicate that application of Miyobi @ 1.1 mgL^{-1} may be toxic for plant growth and development. Control, where only water was sprayed, showed the lowest of the above parameters. The higher fruit yield was recorded in 0.5 and 0.8 mgL^{-1} with being the highest in 0.5 mgL^{-1} (369.8 g plant^{-1}) due to increased number of fruits plant^{-1}. The lowest fruit yield was recorded in control (260.3 g plant^{-1}) due to inferiority in yield attributes. However, application of Miyobi at 0.8 mgL^{-1} was more costly than 0.5 mgL^{-1}. Therefore, Miyobi with 0.5 mgL^{-1} may be applied for increased fruit yield of chili for further recommendation few more field trials will require.

Key words: Chili, Miyobi growth regulator, Fruit yield

Introduction

Chili (*Capsicum annuum* L.) is an important spice in Bangladesh. It is virtually an indispensable item in the kitchen for everyday cooking. Chili is widely grown round the year in all part of the country. But the average yield of chili in Bangladesh is very low compared to other leading chili growing countries in the world (FAO, 2007) due to improper cultivation management practices.

Improvement of existing spice crops through proper cultural management practices need urgent attention to meet increasing demand of edible spices for the fast growing population of Bangladesh. To keep pace with the present population growth and spices production, the modern variety with spices growing area need to be expanded by replacing the local low yielding cultivars under cultivation, and the economic yield per unit area is needed to be increased. There is a little scope for horizontal expansion of chili area. Therefore, attempt to increase per unit production is necessary. That is why, special attention should be made for increasing the yield per unit area by adopting improved technologies and management practices. To increase the chili production, we need to adapt improve production technology and better agronomic practices and use high yielding adapted varieties.

The breeders are successful to develop modern varieties of almost all crops, which are being used by the farmers. It seems that the genetic potentiality of the varieties to increase their production has already been reached to saturation. There are scopes for making breakthrough for improving yield through changes of hormonal behaviours. In this connection, use of plant growth regulators (PGRs) might be a useful alternative to increase crop production. Application of plant growth regulator seems to be one of the important practices in view of convenience, cost and labour efficiency. 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 have long been using PGRs to increase crop yield (Imam *et al*., 2010).

Like other crop plants, the physiological mechanisms of chili growth are hormonally mediated. Additional supply of plant growth regulators (PGRs) control growth and yield in plants. Miyobi, a new synthetic growth hormone (composition is unknown) developed by a Japanese Company (BAL Planning Co. Ltd., Ichinomiyo, Japan). The company claimed that foliar application of Miyobi before flowering enhanced plant growth and development thereby fruit yield in vegetable and spice crops. In Bangladesh, some workers reported that application of Miyobi at vegetative stage increased plant height, total dry mass and seed yield in mungbean (Rahman, 2006), in sesame (Hossain, 2007), in soybean (Khatun, 2008) and in tomato (Imam *et al*., 2010). Research work with Miyobi on growth, yield attributes and fruit yield of chili is absent. Considering the above facts, the present research work was undertaken to study the effect of Miyobi on growth, morphological features, yield attributes and yield in chili under Bangladesh conditions.

Materials and Methods

A pot experiment was carried out at the pot-yard of Bangladesh Institute of Nuclear Agriculture, Mymensingh ($24^0$75″ N and $90^0$50″ E), Bangladesh, during February to June 2011. The soil of the experiment was sandy loam having a total nitrogen 0.06%, organic matter 1.15%, available phosphorus 18.5 ppm, exchangeable potassium 0.28 meq%, sulphur 18 ppm and pH 6.8. The experiment comprised of five concentrations of Miyobi *viz.*, 0, 0.2, 0.5, 0.8 and 1.1 mgL^{-1} which were applied at 30 days after transplanting (DAT) i.e. just before flowering start phase. The spray was done by a hand sprayer at afternoon. The local landrace chilli variety, Narikalkhola was used in the present experiment. The soil was thoroughly mixed with the given amounts of urea, triple superphosphate, muriate of potash, gypsum and cowdung at the rate of 3.70, 2.15, 1.30, 0.80 and 150 g pot^{-1} corresponding to 300, 160, 140, 40 and 10000 kg ha^{-1}, respectively. Total amount of TSP, MP, gypsum and cowdung were applied as basal dose during soil preparation. One forth of urea was applied as basal dose and rest three-forth urea was top dress at 21, 45 and 75 DAT. The pots of the experiment were filled with 12 kg of soils. The experiment was laid out in a Completely Randomized Design (CRD) with 6 replications. A single seedling (Thirty-day old seedlings) was sown in each pot on 01 February 2011. The 5-6th replications was used for dry matter production study. Intercultural operations like irrigation, weeding, mulching, pruning, staking, and pest control were followed as and when necessary for normal plant growth and development. Total dry mass (TDM) plant^{-1}, was recorded at 120 DAT. Plant sample was oven dried at 80 ^{0}C ± 2 for 48 hours. The total dry matter plant^{-1} was estimated by summing dry matter of leaves, stem, root and fruits dry weight per plant. Leaf chlorophyll was measured using the method of Yoshida *et al*. (1976) at 70 DAT. Photosynthesis was measured at flowering stage (60 DAS) by automatic photosynthesis meter (LICOR 6400 FX, USA). Morphological, reproductive and yield attributes were recorded during chili fruit harvest. Harvesting was done at different dates depending on fruit ripening. The collected data were analyzed statistically using the computer package programme, MSTAT-C and the mean differences were adjudged by Duncan's Multiple Range Test (DMRT).

Results and Discussion

The effects of different concentrations of Miyobi on morpho-physiological characters such as plant height, branch, root and leaf number plant^{-1}, growth parameters such as root and stem weight and total dry mass (TDM) plant^{-1} were significant (Table 1). Plant height, branch and leaf number plant^{-1} increased with increasing concentration of Miyobi till 0.5 mgL^{-1} followed by a decline. The tallest plant, highest number of branches and leaves was observed with 0.5 mgL^{-1} and the shortest plant with lowest number of branches and leaves was recorded in control plant or 1.1 mgL^{-1} Miyobi. The root length, root number, root weight, stem weight and TDM plant^{-1} increased with increasing concentration of Miyobi till 0.8 mgL^{-1} followed by a decline. However, the above studied parameters were greater in Miyobi applied plants than control plants. The highest number of roots, root length, root weight plant^{-1}, stem weight plant^{-1} and TDM plant^{-1} was recorded in 8.0 mgL^{-1} Miyobi followed by 0.5 mgL^{-1} Miyobi. The lowest root length, root number, root weight, stem weight and TDM plant^{-1} was recorded in control plants. These results indicate that application of Miyobi had tremendous effect on growth and development in chili. These results have conformity with Imam *et al.* (2010) who reported plant growth and development enhanced by the application of Miyobi in tomato.

Table 1. Effect of different concentrations of Miyobi morphological characters and dry mass production of chili

Concentrations (mgL^{-1})	Plant height (cm)	Branches plant^{-1} (no.)	Leaves plant^{-1} (no.)	Roots plant^{-1} (no.)	Root weight plant^{-1} (g)	Stem weight plant^{-1} (g)	Total dry mass plant^{-1} (g)
0.0	74.5 c	26.7 c	131 c	54.1 c	8.70 d	61.44 c	70.14 c
0.2	82.0 a	35.7 a	159 ab	67.0 b	10.0 ab	72.86 b	82.86 b
0.5	82.5 a	34.0 ab	162 a	68.3 b	9.65 bc	83.66 a	93.25 a
0.8	78.0 b	32.0 b	151 b	80.0 a	10.5 a	84.60 a	95.03 a
1.1	71.3 c	24.0 c	135 c	70.1 b	9.32 cd	70.86 b	80.18 b
F-test	**	**	**	**	**	**	**
CV (%)	3.74	4.28	7.29	5.14	4.51	3.63	4.08

In a column figures having the same letter (s) do not differ significantly at $P \leq 0.05$

** indicates significant at 1% levels of probability

The effects of different levels of concentration of Miyobi application on biochemical parameters such as chlorophyll content in leaves and photosynthesis in leaves, yield attributes such as number of fruits plant^{-1}, fruit length and single fruit weight and fruit yield plant^{-1} were significant (Tables 2 & 3). Results showed that chlorophyll and photosynthesis in leaves increased with increasing concentration of Miyobi till 0.8 mgL^{-1} followed by a decline. The highest chlorophyll and photosynthesis was recorded in 0.8 mgL^{-1} and the lowest was recorded in control plant. For yield attributes, results showed that fruit number increased with increasing concentration of Miyobi till 0.8 mgL^{-1} followed by a decline. This result indicates that 0.8 mgL^{-1} Miyobi is the optimum for getting higher fruit yield in chilli. However, fruit size had reverse trend with comparing fruit number. Fruit length and single fruit weight decreased with increasing Miyobi concentration. The highest fruit length and single fruit weight was recorded in control plants and the lowest was recorded in 1.1 mgL^{-1} Miyobi. The higher fruit yield was recorded in 0.5 and 0.8 mgL^{-1} Miyobi due to production of higher number of fruits plant^{-1}. The lower fruit yield was recorded in control plant due to fewer fruits plant^{-1}. This result indicates that application of Miyobi hormone enhances fruit setting which resulting increased fruit yield in chili.

Table 2. Effect of different concentrations of Miyobi on biochemical and yield attributes of chili

Concentrations (mgL^{-1})	Chlorophyll (mg g^{-1}fw)	Photo-synthesis (μmol CO_2 dm^{-2} s^{-1})	Fruits plant^{-1} (no.)	Fruit length (cm)	Single fruit weight (g)
0.0	61.44 c	24.40 b	88.28 c	7.40 a	3.23 a
0.2	72.86 b	26.61 ab	107.4 b	7.20 ab	2.94 b
0.5	83.66 a	28.31 a	129.4 a	7.20 ab	2.90 bc
0.8	84.60 a	28.66 a	135.1 a	6.90 bc	2.78 cd
1.1	70.86 b	27.89 a	114.0 b	6.60 c	2.70 d
F-test	*	*	**	**	**
CV (%)	3.84	6.30	4.68	3.02	3.17

In a column figures having the same letter (s) do not differ significantly at $P \leq 0.05$
*, ** indicate significant at 5% and 1% levels of probability, respectively

Table 3. Effect of different concentrations of Miyobi on fruit yield of chili

Concentrations (mgL^{-1})	Fruit yield plant^{-1} (g)			
	1st harvest	2nd harvest	3rd harvest	Total
0.0	117 c	68.3 d	50.0 d	260.3 c
0.2	157 b	90.0 c	68.3 b	315.3 b
0.5	193 a	96.6 c	80.3 a	369.8 a
0.8	160 b	120 b	82.7 a	362.7 a
1.1	110 c	133 a	57.7 c	301.0 b
F-test	**	**	**	**
CV (%)	7.57	5.62	4.52	7.72

In a column figures having the same letter (s) do not differ significantly at $P \leq 0.05$
** indicates significant at 1% levels of probability

Conclusion

In conclusion, it can be said that foliar application of Miyobi at vegetative stage enhance plant growth and development which resulted increased fruit yield in chili. Among the concentrations, 0.5 and 0.8 mgL^{-1} had superiority for plant growth, yield component and yield over 0.2 and 1.1 mgL^{-1}. However, application of Miyobi at 0.8 mgL^{-1} was more costly than 0.5 mgL^{-1}. Therefore, application of Miyobi @ 0.5 mgL^{-1} may be recommended for chili cultivation although further field trials is required for confermation.

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