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Performance of Summer Tomato in Response to Maleic Hydrazide

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Abstract- The experiment was conducted at the Horticulture farm, Sher-e-Bangla Agricultural University, Dhaka, Bangladesh, during the period from May 2012 to August 2012. Summer tomato seedlings were sprayed with four levels of maleic hydrazide viz. 0, 20, 40 and 60 ppm were arranged in Randomized Complete Block Design with three replications. Plant growth retardant- maleic hydrazide @ 60 ppm decrease plant height, increases number of leaves, branch, flowers (33%) and fruits (35%) plant^{-1}. It also increases individual fruit weight and yield of tomato ha^{-1} about 32% and 57%, respectively but it did not affect the fruit length and diameter.

Index Terms- Gibberellin biosynthesis, morphological features, plant growth retardant

I. INTRODUCTION

Tomato (*Lycopersicon esculentum*) is the most important and popular vegetable among the fruit crops in Bangladesh. It is receiving increased attention of the growers and consumers in Bangladesh. Winter season is the most suitable time for growing tomato in Bangladesh. When tomatoes are grown during summer in tropical countries to a high temperature and high humidity which reduces stem diameter, pollination, fruit set and, it also causes stem elongation and less tolerant to environmental stress. Plant growth retardants are synthetic compounds which inhibit the plant growth by reducing cell elongation and rate of cell division in plant without changing developmental patterns and obvious phytotoxicity (Davis and Curry, 1991; Rademacher, 2000). It accelerate and uniform the fruits ripening, can promote the defoliation and promote the abscission of fruits, so allowing the mechanical harvesting to be made more efficiently, reducing the losses on varieties which have a tendency to shatter and improving the quality of the obtained products (Neamţu and Irimie, 1991). Maleic hydrazide is a wide spectrum growth retardant that shows a response over many species and the treated plants typically have shorter internodes and thicker green leaves. In Bangladesh, use of plant growth retardant is not a common practice. Therefore, the study was undertaken in order to know the impact of maleic hydrazide on tomato production during summer season.

II. MATERIALS AND METHOD

The experiment was conducted at the Horticulture Farm of Sher-e-Bangla Agricultural University, Dhaka-1207, Bangladesh during May 2012 to August 2012. The location of the experimental site was at 24.09° N latitude and 90.26°E longitude with an elevation of 8.20 meter from sea level. Soil of the experimental field was silty loam in texture under the Agro-Ecological Zone of Madhupur tract (AEZ No. 28). The variety of summer tomato, BARI hybrid tomato - 3 was used. Four levels of maleic hydrazide viz. 0, 20, 40 and 60 ppm as represented by MH_0, MH_1, MH_2 and MH_3, respectively were arranged in Randomized Complete Block Design with three replications. The total area of the experimental plot was divided into three equal blocks where each plot was 1.8 m × 2 m in size. Fertilizers were applied at 80, 25, 50 and 10000 kg ha^{-1} for N, P, K and cowdung, respectively (FRG, 2012). Seedlings about 30 days aged were transplanted to the experimental field on 10th June, 2012 at a spacing of 60 cm × 40 cm. Intercultural operations were furnished for proper growth and development of the crop. The required amount of maleic hydrazide was taken using electronic balance and a stock solution was prepared by dissolving in 1 ml ethanol. Then the stock solution was diluted in distilled water to prepare the working solutions, just before spraying. The solution was directly sprayed on the roots of plant before transplanting and sprayed entire plants three times after transplanting in the main field. Spraying was done using hand sprayer in the early morning to avoid rapid drying-off of the spray solution. Collected data includes plant height, number of leaves, branch, flower clusters, flowers, fruit clusters, fruits and also length, diameter, individual weight and, yield of fruits were analyzed and mean values of all the parameters were adjudged by Duncan's Multiple Range Test (DMRT) at 5% level of probability.

III. RESULTS AND DISCUSSION

III.1. Plant height

Different concentrations of maleic hydrazide significantly influence the plant height of tomato. Plant height was increased gradually with the lower concentrations of maleic hydrazide and the tallest plant was found in control compared with the growth retardant treated plants (Table 1). The inhibitory effect on plant height might be due to the inhibition of cell division and reduction in cell expansion. Plant growth retardants inhibit the conversion of geranyl pyrophosphate to copalyl pyrophosphate of gibberellins biosynthesis which is responsible for shoot elongation and thus maleic hydrazide reduces plant height. This result is compatible with other findings (Singh 2004, Mansuroglu et al. 2009, Caprita and Caprita 2005) where they reported that plant growth retardants inhibit gibberellins biosynthesis, stem and shoot elongation without irreversible blocking of metabolic and developmental processes in plants. It was also demonstrated for other growth retardants like: chlorocholine chloride (CCC) on

sunflower (Lovett and Orchard 1981) and 2,3,5 tri-iodobenzoic acid (TIBA), maleic hydrazide (MH) on sorghum (Hatley et al. 1985, Mehetre and Lad 1995).

III.2. Number of leaves and branch plant^{-1}

Plant growth retardant- maleic hydrazide @ 20-60 ppm on summer tomato significantly increases number of leaves and branch over control (Table 1). The mechanism of increasing the number of leaves and branch due to application of maleic hydrazide @ 60 ppm that lead to slowing down of cell division and reduction in cell expansion as well as reduce plant height but partially increases the number of branches ultimately increases the leaf number. Whipker and McCall (2000) and Hanchinamath (2005) reported that foliar application of mepiquat chloride (1000 ppm) and lihocin (1000 ppm) significantly decreased plant height and increased the number of leaves in cluster bean.

III.3. Number of flowers and fruits plant^{-1}

Plant growth retardant influenced significantly on number of flowers and fruits plant^{-1}. Number of flowers and fruits plant^{-1} was increased about 33% and 35%, respectively when maleic hydrazide applied @ 60 ppm compared with the control (Table 1).

Table 1. Effect of maleic hydrazide on plant height, number of leaves, branch, flowers and fruits plant^{-1}

Treatments	Plant height (cm)	Number of leaves plant^{-1}	Number of branch plant^{-1}	Number of flowers plant^{-1}	Number of fruits plant^{-1}
MH_0	78.98 a	19.43 c	3.083 c	14.60 c	10.68 d
MH_1	73.77 b	21.92 b	3.47 b	15.53 c	12.95 c
MH_2	69.20 c	22.27 b	3.77 b	19.08 b	15.12 b
MH_3	66.17 d	28.43 a	4.72 a	21.92 a	16.50 a
$LSD_{(0.05)}$	2.51	2.42	0.36	1.58	1.30
$LSD_{(0.01)}$	3.48	3.36	0.50	2.20	1.80
CV%	2.81	8.49	7.79	7.18	7.59

In a column, means followed by same letter (s) do not differ significantly at 5% level of probability, MH_0= Control, MH_1= 20 ppm, MH_2= 40 ppm and MH_3= 60 ppm

III.4. Fruit length and diameter

Maleic hydrazide insignificantly affects the fruit length and fruit diameter (Table 2) of summer tomato.

III.5. Individual fruit weight and yield of tomato

Individual fruit weight and yield of tomato ha^{-1} significantly increased about 32% and 57%, respectively with 60 ppm concentration of maleic hydrazide compared to the control (Table 2). The regulatory effect of 60 ppm concentration of maleic hydrazide on fruit weight and yield of tomato might be due to the enhancement of vigorous growth and root system of plants, as a result higher mineral absorption may be stimulated in the root zone and this pursue on the growth, fruit weight and yield of tomato. Chetti (1991) reported that growth retardants like cycocel when applied in groundnut (*Arachis hypogaea*) genotypes, significantly increased chlorophyll content compared to the control. Foliar spray of TIBA @ 50-100 ppm, mepiquat chloride @ 500–100 ppm and lihocin @ 500–1000 ppm increased chlorophyll a, b and total chlorophyll in potato.

Table 2. Effect of maleic hydrazide on fruit length, fruit diameter, individual fruit weight and yield of tomato ha^{-1}

Treatments	Fruit length (cm)	Fruit diameter (cm)	Individual fruit weight (g)	Yiled (t ha^{-1})
MH_0	3.07 a	3.01 a	22.10 b	9.85 d
MH_1	3.25 a	3.20 a	23.77 b	12.83 c
MH_2	3.30 a	3.27 a	31.87 a	20.28 b
MH_3	3.33 a	3.37 a	32.50 a	23.20 a
$LSD_{(0.05)}$	0.32	0.37	2.23	2.19
$LSD_{(0.01)}$	0.44	0.52	3.10	3.05
CV%	7.37	8.59	6.54	10.71

In a column, means followed by same letter (s) do not differ significantly at 5% level of probability, MH_0= Control, MH_1= 20 ppm, MH_2= 40 ppm and MH_3= 60 ppm

IV. CONCLUSION

Growth retardant maleic hydrazide @ 60 ppm concentration was found adjuvant for regulating the growth of tomato plant during summer season. The growth retardant might have potential for adapting summer tomato seedlings to high temperature and high relative humidity at field conditions.

REFERENCES

[1] Caprita, A. and Caprita, R., 2005. Plant growth retardants for the treatment of vegetables used as row materials for the food industry. Scientifical Researches. Agro alimentary Processes and Technology. 11 (1), 173-178.

[2] Chetti, M. B., 1991. Evaluation of Chamatkar on groundnut. Pestology. 25, 43-50.

[3] Davis, T. D. and Curry, E. A., 1991. Chemical regulation of vegetative growth. Critical Rev. Plant Sci., 10 (2), 151-188.

[4] FRG. 2012. Fertilizer Recommendation Guide, Bangladesh Agricultural Research Council (BARC), Farmgate, Dhaka 1215., 117.

[5] Hanchinamath, P. V., 2005. Effect of plant growth regulators, organics and nutrients on growth physiology and yield in clusterbean (Cyamopsis tetragonoloba L. Taub). M. Sc. (Agri.) Thesis, Univ. Agril. Sci., Dharwad, Karnataka, India.

[6] Hatley, O. E., Roth, G. W., Marshall, H. G., Jr, R. R., 1985. Effect of management practices on grain yield test weight and lodging of sorghum. Agron. J., 76 (3), 379-383.

[7] Lovett, G. V. and Orchard, P. W., 1981. Morphological and anatomical changes in sunflower by chloromepiquat and their possible significance. In: proceeding of the 6th International sunflower association, Newel and University Armidal, Astralia., 323-331.

[8] Mansuroglu, S., Karaguzel, O., Ortacesme, V. and Sayan, M. S., 2009. Effect of paclobutrazol on flowering, leaf and flower colour of Consolida orientalis. Pak. J. Bot., 41, 2323-2332.

[9] Mehetre, S. S. and Lad, S. K. 1995. Effect of foliar application of growth substances on growth and yield. Soyabean genetics newsletter. 22, 132-134.

[10] Neamţu, G., Irimie, F., 1991. Fitoregulatori de creştere. Bucureşti: Ed. Ceres.

[11] Singh, A. K., 2004. Response of pot marigold (Calendula officinalis) to plant regulators. Indian J. Agric. Sci., 74, 130–132.

[12] Whipker, B. E. and Mc Call, I., 2000. Response of potted sunflower cultivars to damizonide foliar sprays and paclobutrazol drenches. Hort. Technol., 10 (1), 209-211.

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