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Efficacy of Plant Growth Retardants on Growth, Flowering, Yield and Shelf Life of Dahlia (*Dahlia variabilis* L.) *cv*. Shubhra

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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ABSTRACT

The present investigation Efficacy of plant growth retardants on growth, flowering, yield and shelf life of dahlia (*Dahlia variabilis* L.) cv. Shubhra was conducted in Research Field, Department of Horticulture, Sam Higginbottom University of Agriculture, Technology and Sciences, Prayagraj, during winter season (2022-23). The experiment was laid out in Randomized block design (RBD). There are 9th treatment combination Cycocel (1000,1500, 2000 ppm), Malic Hydrazide

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(1000,2000,3000 ppm), Paclobutrazol (50,100,150 ppm). T_6 malic hydrazide (3000 ppm) better performance compared to others growth retardants treatments parameters like, plant height (70.71 cm), number of leaves plant^{-1}(119.43), number of branches plant^{-1}(7.58), stem diameter (2.36 cm), average of length branches (71.29 cm), days taken for first flower bud initiation (64.96), complete opening of flower days (7.32), number of flower plant^{-1}(17.42), flower diameter(16.07 cm), flower weight (62.35 g), plant peduncle length(16.19 cm), number of flower yield plot^{-1} (156.81), number of flower yield ha^{-1} (65.18 ton.) and shelf life of flower (14.37 days).

Keywords: Plant height; branches; flower yield.

1. INTRODUCTION

Dahlia (*Dahlia variabilis* L.) is a genus of bushy tuberous half hardy herbaceous perennial plant having stout, erect, branched stems bearing pinnate leaves in opposite pairs and terminal brightly colored and capitates type of inflorescences, valued for their gorgeous attractive spectacular flowers. Dahlia also occupies a place of pride in a garden. Dahlias are easy to grow both in field and in pot and all types of dahlias are extensively used for exhibition, garden display and home decoration. This plant is being grown in many parts of the world for its beautiful ornamental blooms of varying shades of colours and for the beautification of gardens, for cut flowers and loose flower.

As per reports 1962 thousand tones loose flower and 823 thousand tones cut flower are produced in 2018-2019. Nearly 95.5 % of the total area is under open cultivation. India has exported about 19726.57 MT of floriculture products to the world for the value of Rs. 571.38 Cr. in 2018-2019. Major exports destinations (2018-2019) USA, Netherland, UK, Germany and UAE are major importing countries of Indian floriculture.

“Dahlia Tubers have been found to contain a good amount of insulin and fructose and also have some medicinal property as they contain small quantity of medicinal active compound such as phytin and benzoic acid. Whereas, insulin extract from tubers of dahlia is used in diagnosis of renal function” (Shukla et al., 2018). “Seeds are good source of fats and proteins which also contain more than 16 per cent oil and 20.9 to 47.0 per cent protein. The root exudate is nematotoxic and the mortality of the nematode is increasing with increase in the concentration of root exudates” (Manjula et al., 2017).

“It belongs to the family Asteraceae. Stems are mostly erect branched, glabrous or scabrous in nature. In less favorable climate Dahlia is mainly treated as an annual” [1].

“Evaluation is a necessary pre-requisite for crop improvement and it will provide a rapid, reliable and efficient means of information to augment the utilization of germplasm” [2].

“Various bulbs/tubers are imported from Netherlands and planted in open field or under shade net during the summer and in unheated polyethylene houses for the September crop in various parts of India” [3].

Moond and Gehlot (2006) reported that “CCC at 4000 ppm recorded significantly more number of flowers per plant compared to other concentrations (2000, 6000, 8000 and 10000 ppm) in chrysanthemum”. Kumar et al. (2006) reported that “application of 5000ppm CCC in tuberose exhibited superiority with respect to duration of flowering (37.13 days), length of spike (76.68 cm) and number of florets per spike (30.84)”.

Moond and Gehlot (2006) reported “in chrysanthemum, MH increase in vase life of flowers with increase in levels of MH (250, 500, 750, 1000 and 1250ppm)”.

2. MATERIALS AND METHODS

The experiment was conducted during winter season of the year 2022-2023 in Research field, Department of Horticulture, Naini Agricultural Institute, Sam Higginbottom University of Agriculture, Technology and Sciences, Prayagraj. The area is situated on the South of Prayagraj on the right bank of Yamuna at Rewa road at a distance of about 6 km from Prayagraj city. It is situated at 25º.8´N latitude and 81º.50´ E longitudes on elevation of 98 meters from the sea level.

The maximum temperature of the location reaches up to 46^{o}C – 48^{o}C and seldom falls as low as 4^{o}C – 5^{o}C. The relative humidity ranges between 20 to 94 per cent. The average rainfalls in this area are around 1013.4 mm annually. The meteorological Data from (November, 2022 to February, 2023).

3. RESULTS AND DISCUSSION

3.1 Growth Parameters

3.1.1 Plant height

At 90 DAP, The minimum plant height was observed in treatment T_6 3000 ppm Maleic Hydrazide (70.71) (cm). Whereas the maximum plant height (96.44) (cm) was recorded in the treatment T_0 Control. This delay in bud appearance may be attributed to the long vegetative phase by the retardants [4] recorded the same with MH in chrysanthemum. Similar results were recorded by Bhattacherjee [5] with alar and ethephon in dahlia, Karaz et al., [6] with paclobutrazol in golden rod and Saika and Talukdar [7] with CCC and MH in tulip.

3.1.2 Number of leaves plant^{-1}

At 90DAP, The maximum number of leaves plant^{-1} was observed in treatment T_6 3000 ppm Maleic Hydrazide (119.43). Whereas the minimum increase number of leaves plant^{-1} (91.11) was recorded in the treatment T_0 Control. This delay in bud appearance may be attributed to the long vegetative phase by the retardants [4] recorded the same with MH in chrysanthemum. Similar results were recorded by Bhattacherjee [5] with alar and ethephon in dahlia, Karaz et al., [6] with paclobutrazol in golden rod and Saika and Talukdar [7] with CCC and MH in tulip.

3.1.3 Number of branches plant^{-1}

At 90DAP, The maximum number of branches plant^{-1} observed in treatment T_6 3000 ppm Maleic Hydrazide recorded (7.58) (cm). Whereas the minimum increase number of branches plant^{-1} (5.15) (cm) was recorded in the treatment T_0 Control. This delay in bud appearance may be attributed to the long vegetative phase by the retardants [4] recorded the same with MH in chrysanthemum. Similar results were recorded by Bhattacherjee [5] with alar and ethephon in dahlia, Karaz et al., [6] with paclobutrazol in golden rod and Saika and Talukdar [7] with CCC and MH in tulip.

3.1.4 Stem diameter

At 90DAP, The maximum increase stem diameter observed in treatment T_6 3000 ppm Maleic Hydrazide (2.36) (cm). Whereas the minimum increase stem diameter (cm) (1.36) was recorded in the treatment T_0 Control. This delay in bud appearance may be attributed to the long vegetative phase by the retardants [4] recorded the same with MH in chrysanthemum. Similar results were recorded by Bhattacherjee [5] with alar and ethephon in dahlia, Karaz et al., [6] with paclobutrazol in golden rod and Saika and Talukdar [7] with CCC and MH in tulip.

3.1.5 Average length of branches

At 90 DAP, The maximum increase average length of branches observed in treatment T_6 3000 ppm Maleic Hydrazide (cm) (71.29). Whereas the minimum increase average of length branches (cm) (47.54) was recorded in the treatment T_0 Control. This delay in bud appearance may be attributed to the long vegetative phase by the retardants [4] recorded the same with MH in chrysanthemum. Similar results were recorded by Bhattacherjee [5] with alar and ethephon in dahlia, Karaz et al., [6] with paclobutrazol in golden rod and Saika and Talukdar [7] with CCC and MH in tulip.

3.2 Floral Parameters

3.2.1 Days taken for first flower bud initiation

The days taken for first flower bud initiation observed in treatment T_6 3000 ppm Maleic Hydrazide recorded minimum days taken for first flower bud initiation (64.96). Whereas the maximum days taken for first flower bud initiation (80.41) was recorded in the treatment T_0 Control. This delay in bud appearance may be attributed to the long vegetative phase by the retardants [4] recorded the same with MH in chrysanthemum. Similar results were recorded by Bhattacherjee [5] with alar and ethephon in dahlia, Karaz et al., [6] with paclobutrazol in golden rod and Saika and Talukdar [7] with CCC and MH in tulip.

3.2.2 Complete opening of flower days

The complete opening of flower days observed in treatment T_6 3000 ppm Maleic Hydrazide recorded minimum complete opening of flower days (7.32). Whereas the maximum complete opening of flower days (14.15) was recorded in the treatment T_0 Control. Increase reported that the dipping treatments with CCC@ 5000 ppm for 1 h significantly increased the number of leaves at first spike emergence (25.29), diameter of unopened flower bud (3.78 cm) and extended duration of flowering (21.38 days). The results were in line with Ganesh et al., [8].

Table 1. Growth parameters of Dahlia (*Dahlia variabilis* L.) cv. Shubhra

Treatment	Treatment Combination	Plant height (cm)	Number of leaves per plant	Number of branches plant^{-1}	Stem diameter (cm)	Average of length branches
T_0	Control	96.44	91.11	5.15	1.36	47.54
T_1	1000 ppm Cycocel	91.19	98.54	6.33	1.80	51.22
T_2	1500 ppm Cycocel	88.70	99.75	6.61	1.89	52.79
T_3	2000 ppm Cycocel	86.81	101.92	6.65	2.07	55.08
T_4	1000 ppm Maleic Hydrazide	75.03	113.62	7.06	2.24	64.86
T_5	2000 ppm Maleic Hydrazide	72.29	116.86	7.49	2.28	67.86
T_6	3000 ppm Maleic Hydrazide	70.71	119.43	7.58	2.36	71.29
T_7	5O ppm Paclobutrazol	85.11	103.38	6.28	2.10	57.42
T_8	100 ppm Paclobutrazol	82.29	106.70	7.31	2.14	59.08
T_9	150 ppm Paclobutrazol	79.40	109.35	6.71	2.19	61.15
	F-test	S	S	S	S	S
	S.Ed. (±)	0.991	0.865	0.139	0.048	0.509
	CD at 0.5 %	2.082	1.817	0.293	0.101	1.070

Table 2. Floral parameters and yield of Dahlia (*Dahlia variabilis* L.) cv. Shubhra

Treatment	Treatment Combination	Duration of first flower bud initiation	Complete opening of flower days	No. of flower plant^{-1}	Self life	Flower diameter (cm)	Flower weight (g)	No. of flower yield plot^{-1}	No. of flower yield ha^{-1} (in Tonnes)
T_0	Control	80.41	14.15	6.19	9.56	12.22	33.64	55.71	12.61
T_1	1000 ppm Cycocel	77.49	13.33	8.99	10.07	13.56	36.49	80.87	19.67
T_2	1500 ppm Cycocel	76.56	12.99	9.94	10.41	13.84	39.87	89.43	23.77
T_3	2000 ppm Cycocel	75.32	12.71	10.48	10.81	14.21	42.31	94.32	26.60
T_4	1000 ppm Maleic Hydrazide	68.17	9.07	13.81	13.58	15.61	55.79	124.29	46.22
T_5	2000 ppm Maleic Hydrazide	67.42	8.27	15.70	14.20	15.83	58.22	141.30	54.82
T_6	3000 ppm Maleic Hydrazide	64.96	7.32	17.42	14.37	16.07	62.35	156.81	65.18
T_7	5O ppm Paclobutrazol	74.61	12.16	11.86	11.95	14.50	46.14	106.71	32.82
T_8	100 ppm Paclobutrazol	72.27	11.09	12.38	12.34	16.68	48.25	111.42	35.84
T_9	150 ppm Paclobutrazol	70.82	10.42	13.14	13.05	15.20	52.28	118.29	41.23
	F-test	S	S	S	S	S	S	S	S
	S.Ed. (±)	0.585	1.954	0.516	0.370	0.457	1.02	4.645	0.310
	CD at 0.5 %	1.230	0.384	1.084	0.778	0.961	2.140	9.759	0.651

3.2.3 Number of flower plant^{-1}

"The number of flower plant^{-1} among the different treatments differed significantly. The treatment T_6 3000 ppm Maleic Hydrazide recorded maximum number of flower plant^{-1} (17.42). Whereas the minimum number of flower plant^{-1} (6.19) was recorded in the treatment T_0 Control. Increase in the flower number might be attributed to production of more number of primary and secondary branches under the influence of growth retardants". Gowda and Jayanthi [9] attributed the increase in number of flowers per plant in African marigold to the development of large number of auxiliary shoots as a result of cessation of terminal growth following application of growth retardants. Whipker et al., [10] also observed "increased flower number in geraniums after application of growth retardants". Haqu et al., [11] and Pushkar et al., [12] also reported "increase in flower yield with application of growth retardants".

3.2.4 Flower diameter

The flower diameter (cm) among the different treatments differed significantly. The treatment T_6 3000 ppm Maleic Hydrazide recorded maximum flower diameter (cm) (16.16). Whereas the minimum flower diameter (cm) (12.22) was recorded in the treatment T_0 Control. Increasing trend in ethephon and MH is due to increase in the flower size while increase in alar is due to increase in thickness of the petals. The results were in line with Arshid et al., [13] and Saika Talukdar [7].

3.2.5 Flower weight

The treatment T_6 3000 ppm Maleic Hydrazide recorded maximum flower weight (g) (62.35). Whereas the minimum flower weight (g) (33.64) was recorded in the treatment T_0 Control. Increasing in most collections foliar application of glutathione at 150 mg / l gave the highest significant increase in number of flowers/plant, fresh weight of flowers (g/plant) and dry weight of flowers (g/plant) followed by paclobutrazol 100 mg/l compared with untreated plants. The results were in line with Mona et al., [14].

3.2.6 Shelf life of flower

The Shelf life of flower (days) among the different treatments differed significantly. The treatment T_6 3000 ppm Maleic Hydrazide recorded maximum Shelf life of flower (days) (14.37). Whereas the minimum Shelf life of flower (days) (9.56) was recorded in the treatment T_0 Control. Application of GA3 at 100, 200, 300 ppm and NAA at 50, 100, 150 ppm and Maleic Hydrazide (MH) at 250, 500, 750 ppm at 30, 45, 60 days after transplanting. GA3 200 ppm gives better flower yield. In treatment T5 (GA3 200 ppm). Increase number of leaves, number of branches, size of flower, early flower emergence, number of flowers per plant, high yield and maximum self life was observed in treatment T5 The results were in line with Prasad et al., [15].

3.3 Yield Parameters

3.3.1 Number of flower yield plot^{-1}

The number of flower yield plot^{-1} among the different treatments differed significantly. The treatment T_6 3000 ppm Maleic Hydrazide recorded maximum number of flower yield plot^{-1} (156.81). Whereas the minimum number of flower yield plot^{-1} (55.71) was recorded in the treatment T_0 Control. Increase in the flower number might be attributed to production of more number of primary and secondary branches under the influence of growth retardants. Gowda and Jayanthi [9] attributed "the increase in number of flowers per plant in African marigold to the development of large number of auxiliary shoots as a result of cessation of terminal growth following application of growth retardants. Whipker et al., [10] also observed increased flower number in geraniums after application of growth retardants". Haqu et al., [11] and Pushkar et al., [12] also reported "increase in flower yield with application of growth retardants".

3.3.2 Number of flower yield ha^{-1}

The number of flower yield ha^{-1} among the different treatments differed significantly. The treatment T_6 3000 ppm Maleic Hydrazide recorded maximum number of flower yield ha^{-1} (11.07). Whereas the minimum number of flower yield ha^{-1} (3.75) was recorded in the treatment T_0 Control. Increase in the flower number might be attributed to production of more number of primary and secondary branches under the influence of growth retardants. Gowda and Jayanthi [9] attributed "the increase in number of flowers per plant in African marigold to the development of large number of auxiliary shoots as a result of cessation of terminal growth following application of growth

retardants. Whipker et al., [10] also observed increased flower number in geraniums after application of growth retardants". Haqu et al., [11] and Pushkar et al., [12] also reported "increase in flower yield with application of growth retardants".

4. CONCLUSION

In the present investigation it is include that, The treatment T_6 3000 ppm Maleic Hydrazide was found to be best in Agro climatic condition of Prayagraj in terms of growth parameters, number of flower plant^{-1}, flower diameter, flower weigh, number of flower yield plot^{-1}, number of flower yield ha^{-1} and shelf life of flower, net profit/ha (2731161.50) and cost benefit ratio (1:6.74) higher compared to other treatments. Hence the T_6 (300ppm Maleic Hydrazide) could be recommended for commercial purpose in Prayagraj Agro climatic conditions.

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

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