Research Article

Effect of Paclobutrazol on Growth and Flowering in Marigold cv. Pusa Narangi Gainda

Hemlata*[1] and Anil K. Singh[2]

[1]Division of Floriculture and Medicinal Crops, ICAR-IIHR Hesarghatta (outreach campus of ICAR-IARI, New Delhi) Bengaluru-560 089
[2]Department of Horticulture, Institute of Agricultural Sciences, Banaras Hindu University, Varanasi- 221 005

Abstract

A field experiment was carried out a Horticulture Research Farm Department of Horticulture, B.H.U., Varanasi during 2014 to find out the effect of paclobutrazol on growth and flowering in marigold. Treatment consists of 1, 2, 3, 4, 5, 6 7 mg/ plant paclobutrazol (PP333) along with control (distilled water). An experiment was laid out in a randomized block design with three replications. Application of 6 mg/ plant PP333 resulted in a maximum number of leaves/ plant, number of secondary branches/ plant, early bud initiation, fresh weight of flower and number of flower/ plant. Treatment 5 mg/ plant PP333 exhibited early flowering, maximum diameter of bud, and length of bud and weight of flowers/ plant. A Higher dose of PP333 i.e. 7 mg/ plant recorded a maximum number of petals/ flower and dry weight of flower. Treatment 3 mg/ plant PP333 produced bigger size of flower and increased duration of flowering.

Keywords: Paclobutrazol, marigold, growth, flower

***Correspondence**
Author: Hemlata
Email: hemlataiihr2014@gmail.com

Introduction

Marigold is the most important loose flower crop in India. It occupies a prominent place in Indian flower market and also in the international market. It is also used as a loose flower, pot plant, bedding plant, landscaping, in poultry to increase yellow colour of eggs, as a food colouring agent, nutraceuticals and phytochemical [1]. The demand of marigold is increasing and to meet the demand it is important to increase production and productivity as the land is shrinking resource. To accelerate or modify the production and productivity, plant harmones, growth regulators and retardants have been found playing important role in floricultural crops. Paclobutrazol is reported to increase aesthetic value of some flower crops [2]. Paclobutrazol is a growth retardant, it works as anti-gibberellin however it does not check the gibberellins production but compete for the same site of attachment and check the gibberellins action [3-4]. Transport of paclobutrazol occurs passively in the xylem [5-7] with little to no movement in the phloem [8]. Its application results in a reduction in plants height, number of side branches, flowers in different crops [6, 9-12]. The present study was carried out to study the effect of paclobutrazol on growth and flowering of marigold cv. Pusa Narangi Gainda.

Experimental

The experiment was carried out at Horticulture Research Farm, Institute of Agricultural Sciences, B.H.U., Varanasi (India). The one-month-old seedlings of marigold cv. Pusa Narangi Gainda were planted in the field in the month of January 2014 at 60 cm row to row distance and 30 cm plant to plant distance. Single pinching was practiced and paclobutrazol drenching was done after 30 days of transplanting. Treatment consisted of 1, 2, 3, 4, 5, 6, 7 mg/ plant paclobutrazol along with control (distilled water). The dose was dissolved in 200 ml distilled water and drenched in the base of the individual plant. In a similar manner, 200 ml distilled water was applied to control plants. Second drenching was done at 15 days interval. Before drenching, the field was irrigated and also one shallow hoeing near the stem, to ensure good absorption of paclobutrazol. The experiment was laid out in a randomized block design with three replications. All the cultural practices were same as recommended.

Results and Discussions

Growth parameters

Paclobutrazol significantly influenced the growth parameters except for dry weight of leaves. A maximum number of leaves per plant was recorded with 6 mg/ plant paclobutrazol (PP333) followed by 3 mg and 2 mg/ plant PP333 which was statistically significant with 1 mg/ plant PP333 and control. Treatment 6 mg/ plant PP333 also recorded maximum number of secondary branches per plant followed by 3 mg/ plant PP333 (**Table 1**). This was found statistically significant with control. Treatment 4 mg/ plant PP333 recorded maximum length of primary branches followed by 3 mg and 5 mg/ plant paclobutrazol applications. This was found statistically significant over the treatment 7 mg/ plant paclobutrazol and control plants. Maximum number of leaves, secondary branches, leaf area was recorded with 6 mg/ plant PP333. This might be due to reason that paclobutrazol checks the concentration of gibberellins and auxins which result in a decrease in apical dominance and increased the number of secondary branches. Increased number of branches produce more leaf and hence leaf area increases. Present findings are also experimentally corroborated by earlier workers. In previous studies, it was found that it increased number of leaves per plant and leaf area in African marigold cv. Giant Double [10], branches in calendula [13] and snapdragon [14].

Table 1 Influence of paclobutrazol on growth parameters in marigold cv. Pusa Narangi Gainda

Treatment	No. of leaves/ plant	No. of secondary branches/ plant	Length of primary branches (cm)	Dry weight of leaf	Leaf area (cm^2)
Control	222.16	14.94	31.70	0.1698	3697.65
1 mg/ plant PP333	246.16	20.11	38.94	0.1756	3577.70
2 mg/ plant PP333	324.83	21.66	36.5	0.1670	6743.42
3 mg/ plant PP333	330.83	24.89	46.47	0.1643	6605.03
4 mg/ plant PP333	275.33	18.78	47.81	0.1616	5051.91
5 mg/ plant PP333	253.33	23.11	41.72	0.1703	3583.59
6 mg/ plant PP333	349.66	26.44	40.26	0.1642	8009.63
7 mg/ plant PP333	291.83	21.61	35.26	0.1624	4954.24
C.D. at 5%	97.30	7.79	10.30	0.018	2919.49

Flowering parameters

Paclobutrazol significantly influenced the flowering parameters. Treatment 6 and 5 mg/ plant PP33 recorded early 50% bud initiation, however plants treated with 5 mg/ plant PP333 recorded early 50% flowering followed by 3 mg/ plant PP333 (**Table 2**). Treatment 5 mg/ plant PP333 resulted in maximum bud diameter and length of bud. Minimum bud diameter and length were observed in treatments 7 mg/ plant PP333.

Table 2 Influence of paclobutrazol drenching on flowering parameters in marigold cv. Pusa Narangi Gainda

Treatment	Days to 50% bud initiation	Days to 50% flowering	Bud diameter (mm)	Bud length (mm)	Length of peduncle (cm)	No. of petal/ flower
Control	51.66	66.33	13.77	21.48	8.71	93.40
1 mg/ plant PP333	49.00	66.66	14.02	14.01	5.88	92.43
2 mg/ plant PP333	50.33	68.66	14.07	14.23	6.66	87.33
3 mg/ plant PP333	50.00	63.66	13.36	17.10	7.23	79.13
4 mg/ plant PP333	49.66	69.66	14.26	21.52	5.68	89.20
5 mg/ plant PP333	48.66	63.33	14.61	23.41	6.46	101.07
6 mg/ plant PP333	48.66	68.00	13.17	23.13	7.39	80.90
7 mg/ plant PP333	55.00	67.33	12.17	23.26	7.06	140.77
C.D. at 5%	2.82	4.46	1.40	2.45	0.94	36.34

Paclobutrazol treatments significantly reduced peduncle length. Minimum peduncle was recorded with 4 mg/ plant PP333 and maximum with the control which was statistically significant with each other. Application of paclobutrazol significantly influenced fresh and dry weight of flowers (**Table 3**). Maximum fresh weight and dry

weight of flower were recorded with 6 and 7 mg/ plant PP333, respectively. Paclobutrazol suppress vegetative growth thus convert all vegetative buds into reproductive [15]. In calendula paclobutrazol, soil drenching increased fresh and dry weight [13]. Increase in flower weight was observed with paclobutrazol application. Paclobutrazol increase carbohydrate assimilation in plant thus fresh and dry weight increases. Treatment 3 mg/ plant PP333 recorded maximum diameter of flower (63.19 mm) which was statistically significant to control (Table 3). Treatment 6 mg/ plant PP333 also recorded maximum number of flowers/ plant and which was statistically significant to control (Table 3). However, treatment 5 mg/ plant PP333 registered maximum weight of flowers/ plant. It was statistically significant to untreated (control) plants. Similarly, paclobutrazol drenching increased flower yield in China aster [16]. Application of paclobutrazol was found effective to improve flower longevity. Maximum duration of flowering was recorded with 3 mg/ plant PP333. Paclobutrazol application prolonged flowering period in zinnia [17]. Application of paclobutrazol was reported beneficial in production of flower of rose [2] and marigold [10].

Table 3 Influence of paclobutrazol drenching on flower yield of marigold cv. Pusa Narangi Gainda

Treatment	Fresh weight of flower (g)	Dry weight of flower (g)	Diameter of flower (mm)	No. of flowers/ plant	Weight of flower/ plant (g)	Flower longevity (days)	Duration of flowering (days)
Control	6.97	0.701	52.86	41.44	271.88	11.44	128.89
1 mg/ plant PP333	8.78	0.668	57.80	30.30	230.89	10.66	126.44
2 mg/ plant PP333	7.61	0.766	56.82	32.89	291.43	11.44	127.44
3 mg/ plant PP333	7.75	0.703	63.19	36.00	227.58	12.89	134.44
4 mg/ plant PP333	6.33	0.750	57.45	42.00	322.85	12.56	125.56
5 mg/ plant PP333	6.58	0.656	61.89	40.22	379.51	12.00	118.22
6 mg/ plant PP333	9.31	0.783	61.00	51.55	357.36	12.89	127.89
7 mg/ plant PP333	7.71	1.071	61.98	44.34	342.83	12.89	117.22
C.D. at 5%	2.64	0.232	5.42	8.09	128.89	1.40	6.48

Conclusion

The experimental results suggest that paclobutrazol produced significant effects on growth and flowering parameters of marigold cv. Pusa Narangi Gainda. The treatment 6 mg paclobutrazol resulted in maximum number of leaves per plant, secondary branches per plant, leaf area per plant, fresh and dry weight of flowers and early bud initiation whereas, treatment 5 mg paclobutrazol resulted in early flowering, maximum bud diameter and length of bud and weight of flowers per plant.

Acknowledgment

Authors acknowledge DBT, Govt. of India, New Delhi, India for providing financial assistance to carry out this research work.

References

[1] A.K. Singh, Flower Crops: cultivation and Management, New India Publishing Agency, New Delhi, 2006, p463.
[2] A.K. Singh L.D. Bist, Indian SirJournal of Horticulture, 2003, 60, 188.
[3] E. Tanimoto, Pl. Cell Physiol., 1987, 28, 963.
[4] J.C. Latimer, HortScience, 1991, 26, 557.
[5] J.E. Barrett, C.A. Bartuska, HortScience, 1982, 17, 737.
[6] Y. Wang, J.J. Ren, X.H. Sun, J.F. Gu, J. Foshan Univ. (Natural Sci. Edition), 2006, 1, 019.
[7] J.D. Early, G.C. Martin, HortScience, 1988, 23(1), 196.
[8] P.J. Richardson, J.D. Quinlan, Pl. Growth Reg., 1986, 4, 347.
[9] G. Incrocci, S. Mugnai, P. Vernieri, G. Serra, F. Tognoni, Colture Protette, 2003, 32(2), 105.
[10] A.K. Singh, The Horticulture Journal, 2004, 17, 79-82.
[11] D.K. Mishra, H.R. Mishra, L.P. J. Yadava, Applied Horti., 2005, 7(1),34.

[12] J.L. Boldt, Whole plant response of Chrysanthemum to paclobutrazol, chlormequat and (S)-Absvisic acid as a function of exposure time using a split root system. 2008. MSc. Thesis, The University of Florida.
[13] M.H. Mahgoub, N.G. Abd El Aziz, A.A. Youssef, Journal on Applied Sciences Research, 2006, 879.
[14] N.T.A. Shanan, A.S. Soliman, American-Eurasian Journal on Sustainable Agriculture, 2011, 5, 150.
[15] M.A. Bekheta, S. Abbas, O.S. El-Kobisy, M.H. Mahgoub, Australian Journal Basic and Apllied Science, 2008, 2, 1284.
[16] P.M. Munikrishnappa, S.Y. Chandrashekar, Agricultural Reviews, 2014, 35, 57.
[17] Y. Wang, J.J. Ren, X.H. Sun, J.F. Gu, Journal Foshan University (Natural Science Edition) 2006, 1, 019.

Publication History
Received 16th Mar 2017
Revised 28th Mar 2017
Accepted 04th Apr 2017
Online 30th Apr 2017