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BP Shirsat
Dr. B. S. Konkan Krishi
Vidyapeeth, Dapoli, Maharashtra,
India

KV Malshe
Dr. B. S. Konkan Krishi
Vidyapeeth, Dapoli, Maharashtra,
India

Effect of plant growth regulators and pinching on bud and flower size in Gaillardia

BP Shirsat and KV Malshe

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Abstract

The field trial was carried out at College of Horticulture, Dapoli during the Rabi season of 2020-21 to assess the effect of plant growth regulator and pinching on bud and flower size in Gaillardia. The experiment was laid out in Factorial Randomized Block Design comprising seven treatments of plant growth regulators (Factor A) coupled with pinching practices (Factor B) and replicated three times. The PGR treatments were T₁-Control, T₂-Ethephon @ 500 ppm, T₃-Ethephon @ 1000 ppm, T₄-GA₃ @ 100 ppm, T₅-GA₃ @ 200 ppm, T₆-CCC @ 1000 ppm and T₇- CCC @ 2000 ppm with pinching each consisting of two levels as P₁ - Pinching at 30 days after transplanting and P₂ - No pinching. Maximum flower bud length (9.09 mm) was observed in T₁ (Control). It was followed by T₇ (CCC @ 2000 ppm) 7.48 mm. The lowest flower bud length (6.23 mm) was observed in T₂ (Ethephon @ 500 ppm). Largest flower bud (7.44 mm) was observed in P₁ (Pinching at 30 DAT) and minimum flower bud length (7.17 mm) was recorded in no- pinching treatment (P₂). The interaction effect between plant growth regulator and pinching on average bud length of flower was non-significant. The maximum bud width (16.23 mm) was recorded in treatment T₄ (GA₃ @ 100 ppm) and was followed by T₅ (GA₃ @ 200 ppm) 14.76 mm which was at par with Control. The flower bud width was observed minimum (11.78 mm) in the treatment T₃ (Ethephon @ 1000 ppm). Maximum flower bud width (14.32 mm) was observed in P₁ (Pinching at 30 DAT) and minimum flower bud width (13.53 mm) was recorded in P₂ (no- pinching treatment). The highest bud width (16.72 mm) was observed in T₄P₁ (GA₃ @ 100 ppm + pinching at 30 DAT). The lowest bud width (11.43 mm) was observed in T₃P₂ (Ethephon @ 1000 ppm + No-pinching). Significantly maximum flower stalk length (30.53 cm) was observed in the treatment T₅ (GA₃ @ 200 ppm). The shortest flower stalk length (16.17cm) was recorded in the treatment T₃ (Ethephon @ 1000 ppm). Pinching treatment does not significantly influence on flower stalk length. The interaction effect between plant growth regulator and pinching on flower stalk length was also found non-significant. The largest flower diameter (8.23 cm) was recorded in the treatment T₇ (CCC @ 2000 ppm) and the least flower diameter (4.26cm) was in GA₃ @ 100 ppm treatment (T₄). Maximum flower diameter (6.44 cm) was recorded in P₁ (pinching at 30 DAT). The shortest flower diameter (6.13 cm) was measured in P₂ (no-pinching) treatment. In interaction, maximum flower diameter (8.43 cm) recorded in T₇P₁ (CCC @ 2000 ppm +pinching at 30 DAT). The minimum flower diameter (4.15 cm) was observed in T₄P₂ (GA₃ @ 100 ppm + no-pinching).

Keywords: Gaillardia, bud, flower, pinching, GA₃, CCC

Introduction

The Gaillardia (*Gaillardia pulchella*) belongs to Asteraceae family and generally grown for its cut flowers. Its loose flowers are used for making garlands in religious occasion and for decoration during social functions. It is commonly called 'blanket flower'. Among the commercial flowers, this crop is easy to cultivate. Several factors like, genetic, environment and management are influencing the successful commercial cultivation of the crop. However, the importance should be given on the regulation of growth, yield and quality of flowers by using some plant growth regulators. In the development of the sustainable package of practices for achieving higher yield of flowers, use of the growth regulators (bioregulators) is one of the means (Kadam *et al.*, (2020) ^[2, 3]. Pinching is the cultural practice which is followed in flower crops to stimulate early emergence of side branches which ultimately produces more no of flowers with good quality and uniform size. Pinching reduces the height that promote axillary branches, delays flowering and helps in breaking resting period (Sehrawat *et al.*, 2003) ^[8].

Corresponding Author:
BP Shirsat
Dr. B. S. Konkan Krishi
Vidyapeeth, Dapoli, Maharashtra,
India

The effects of such practices viz; use of plant growth regulator and pinching also influence the size of flowers. With this view the present experiment was undertaken to assess the effect of plant growth regulator and pinching on bud and flower size in Gaillardia.

Materials and Methods

The field trial was carried out at College of Horticulture, Dapoli during the Rabi season of 2020-21. The experiment was laid out in Factorial Randomized Block Design comprising seven treatments of plant growth regulators (Factor A) coupled with pinching practices (Factor B) and replicated three times. The PGR treatments were T₁-Control, T₂-Ethephon @ 500 ppm, T₃-Ethephon @ 1000 ppm, T₄-GA₃ @ 100 ppm, T₅-GA₃ @ 200 ppm, T₆-CCC @ 1000 ppm and T₇- CCC @ 2000 ppm with pinching each consisting of two levels as P₁ - Pinching at 30 days after transplanting and P₂ - No pinching. The net plots with 1.2 × 1.8 m size were prepared by following preparatory tillage operations and transplanting of 30 days old healthy and uniformly grown seedlings was done at 30 cm X 30 cm spacing. The recommended intercultural operations were followed to grow the plants. The spraying with different growth regulators was done four times i.e. 30, 60, 90 and 120 days after transplanting while pinching was done at 30 days after transplanting. The observations on the bud and flower size were recorded. The data were statistically analyzed by the method suggested by Panse and Sukhatme (1985) [4].

Results and Discussion

The data presented in Table 1 revealed that the application of plant growth regulators had significant effect on flower bud length. Maximum flower bud length (9.09 mm) was observed in T₁ (Control). It was followed by T₇ (CCC @ 2000 ppm) 7.48 mm which was at par with T₆ and T₅. The lowest flower bud length (6.23 mm) was observed in T₂ (Ethephon @ 500 ppm). Pinching had significant influence on flower bud length. Largest flower bud (7.44 mm) was observed in P₁ (Pinching at 30 DAT) and minimum flower bud length (7.17 mm) was recorded in no-pinching treatment (P₁). The interaction effect between plant growth regulator and pinching on average bud length of flower was non-significant. It was in the range of 6.18 to 9.25 mm.

The data indicate that the application of plant growth regulators showed the significant influence on flower bud width. The maximum bud width (16.23 mm) was recorded in treatment T₄ (GA₃ @ 100 ppm) and was followed by T₅ (GA₃ @ 200 ppm) 14.76 mm which was at par with Control. The flower bud width was observed minimum (11.78 mm) in the treatment T₃ (Ethephon @ 1000 ppm). The role of GA₃ with optimum level improving the bud width ascribed to the translocation of metabolites at the site of bud development, increase in diameter of florets might be due to cell elongation of flower. Similar result was reported earlier by Kadam (2020) [2, 3] in Gaillardia. Reduction in the flower bud width in the Ethephon treatments may be due to more energy consumption for development of stalk length as well as of flower buds per plant. Pinching had significant influence on flower bud width. Maximum flower bud width (14.32 mm) was observed in P₁ (Pinching at 30 DAT) and minimum flower bud width (13.53) mm was recorded in P₂ (no-pinching treatment).

The interaction effect between plant growth regulator and pinching significantly influenced the average bud width of Gaillardia. The highest bud width (16.72 mm) was observed in T₄P₁ (GA₃ @ 100 ppm + pinching at 30 DAT) which was followed by T₄P₂ (GA₃ @ 200 ppm + no-pinching). The lowest

bud width (11.43 mm) was observed in T₃P₂ (Ethephon @ 1000 ppm + No-pinching). GA₃ application with pinching treatment observed maximum bud width of Gaillardia. This is might be due to translocation of metabolites at the site of bud development.

It is evident from the data presented in Table 2 that length of flower stalk was significantly differed due different plant growth regulators. Significantly maximum flower stalk length (30.53 cm) was observed in the treatment T₅ (GA₃ @ 200 ppm) and it was followed by treatment T₄ (27.18 cm) and T₁ (25.58). The shortest flower stalk length (16.17cm) was recorded in the treatment T₃ (Ethephon @ 1000 ppm). The increase in stalk length is a direct effect of plant growth regulators used. The significant increase in stalk length may be characteristics effect of plant growth regulators used which promote cell division and cell elongation. In present studied it was observed that maximum stalk length was recorded in GA₃ treated plants. Similar types of observations were made by Patil (2004) [6] and Ghadage *et al.* (2013) [1] in Marigold. Minimum flower stalk length was noticed in Cycocel and ethephon treatment than the control. Role of Cycocel is to restrain the growth of stem and leaves without development of reproductive organs. This might be the reasons for minimum length of flower stalk in Gaillardia. Pinching treatment does not significantly influence on flower stalk length. The interaction effect between plant growth regulator and pinching on flower stalk length was also found non-significant.

The data presented in Table 2 indicate that the flower diameter was significantly varied due to plant growth regulators application. The largest flower diameter (8.23 cm) was recorded in the treatment T₇ (CCC @ 2000 ppm) which was followed by the Control (7.84 cm) and T₆ (7.54 cm). The least flower diameter (4.26cm) was in GA₃ @ 100 ppm treatment (T₄).

Significantly maximum diameter of fully open flower was observed in Cycocel treatment. This indicates that the flowers with more diameter obtained under growth retardants treatments may be due to the availability of more carbohydrates and elaborate food material during the development of flower having more green biomass in these treatment and also due to effect lead to decrease in cell size, internodal length, with a promotive activity on side shoots to sprout and increased flower diameter.

The above results obtained during experiment are closely agreement with the findings of Saiyed (2009) [7] and Kadam (2020) [2, 3] in Gaillardia. Reduction in the flower diameter in the GA₃ treatments may be due to more energy consumption for development of more stalk length. Ethephon treatments also reduced the flower diameter than the control and Cycocel.

Pinching has significant influence on flower diameter of Gaillardia. Maximum flower diameter (6.44 cm) was recorded in P₁ (pinching at 30 DAT). The shortest flower diameter (6.13 cm) was measured in P₂ (no-pinching) treatment.

Increase in flower diameter under pinching treatment might be due to physiological effect of pinching practice which can be helpful to gain of extra energy. Similar results were observed by Patade *et al.* (2020) [5] in marigold.

The interaction effect between plant growth regulators and pinching on flower diameter was significantly differed. In interaction, maximum flower diameter (8.43 cm) recorded in T₇P₁ (CCC @ 2000 ppm +pinching at 30 DAT) which was at par with T₁P₁ (Control + pinching at 30 DAT) 8.37 cm, T₇P (CCC @ 2000 ppm+ no-pinching) 8.03 cm. The minimum flower diameter (4.15 cm) was observed in T₄P₂ (GA₃ @ 100 ppm + no-pinching) which was at par with T₄P₁. From the interaction effect it is cleared that the CCC @ 2000 ppm with pinching

shows higher flower diameter which may be due to favorable effect of CCC and pinching in carbohydrate accumulation.

Table 1: Effect of plant growth regulators and pinching on Average bud length and bud width of Gaillardia

Treatment combinations	Average bud length (mm)			Average bud width (mm)		
	P ₁	P ₂	Mean	P ₁	P ₂	Mean
T ₁	9.25	8.92	9.09	15.01	14.19	14.60
T ₂	6.27	6.18	6.23	12.95	11.65	12.30
T ₃	6.70	6.59	6.65	12.13	11.43	11.78
T ₄	7.21	7.14	7.17	16.72	15.73	16.23
T ₅	7.37	7.06	7.21	15.05	14.47	14.76
T ₆	7.50	7.17	7.34	14.32	13.38	13.85
T ₇	7.81	7.15	7.48	14.07	13.82	13.94
Mean	7.44	7.17	7.31	14.32	13.53	13.92
	S.Em ±	C.D at 5%	Result	S.Em±	C.D at 5%	Result
T	0.10	0.28	SIG	0.04	0.12	SIG
P	0.05	0.15	SIG	0.02	0.07	SIG
TxP	0.14	-	NS	0.06	0.17	SIG

Table 2: Effect on plant growth regulators and pinching on stalk length and flower diameter of Gaillardia

Treatment combinations	Stalk length (cm)			Flower diameter (cm)		
	P ₁	P ₂	Mean	P ₁	P ₂	Mean
T ₁	26.23	24.93	25.58	8.37	7.31	7.84
T ₂	20.03	19.07	19.55	5.30	5.91	5.60
T ₃	17.27	15.07	16.17	5.14	5.13	5.13
T ₄	27.73	26.63	27.18	4.37	4.15	4.26
T ₅	30.67	30.40	30.53	5.55	5.23	5.39
T ₆	19.90	19.90	19.90	7.90	7.18	7.54
T ₇	21.33	20.40	20.87	8.43	8.03	8.23
Mean	23.20	22.44	22.84	6.44	6.13	6.29
	S.Em ±	C.D at 5%	Result	S.Em±	C.D at 5%	Result
T	0.48	1.40	SIG	0.12	0.36	SIG
P	0.26	-	NS	0.07	0.19	SIG
TxP	0.68	-	NS	0.18	0.51	SIG

PGRs Treatments:		Pinching Treatments:
T ₁ –Control	T ₂ – Ethephon @ 500 ppm	P ₁ - Pinching @ 30 DAT
T ₃ – Ethephon @ 1000 ppm	T ₄ – GA ₃ @ 100 ppm	P ₂ – No pinching
T ₅ – GA ₃ @ 200 ppm	T ₆ – CCC @ 1000 ppm	
T ₇ – CCC @ 2000 ppm		

Conclusion

From the present investigation, it is inferred that, plant growth regulators and pinching practice significantly altered the bud and flower size in gaillardia. The maximum flower diameter was observed in CCC @ 2000 ppm with pinching at 30 DAT treatment.

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