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Effect of plant growth regulators and pinching on flowering characters in gaillardia (*Gaillardia pulchella*)

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Abstract
The present investigation was carried out at Floriculture Farm of College of Horticulture, Dapoli during the Rabi season of 2020-21 to assess the effect of plant growth regulator and pinching practice on flowering in gaillardia. The experiment was laid out in Factorial Randomized Block Design comprising seven treatments of plant growth regulators coupled with piching practices and replicated three times. Seven treatments were tried with three growth regulators (Main factor)as T_1-Control, T_2-Ethephon @500ppm, T_3-Ethephon @ 1000 ppm, T_4-GA_3 @ 100 ppm, T_5-GA_3 @ 200 ppm, T_6-CCC @ 1000 ppm and T_7- CCC @ 2000 ppm with pinching each consisting of two levels (Sub plot) as P_1-Pincning at 30 days after transplanting and P_2-No pinching. The significantly early initiation of flowering (60.33DAT), least number of days required for 50% flowering (70.00 days) and the longest flowering duration (137.83 days) were observed in treatment T_5 (GA_3 @ 200ppm). The delayed flowering initiation (81.83DAT) was observed in T_6 (CCC@1000ppm) treatment. Early initiation of flowering (69.67DAT) and least days required for 50% flowering (79.00 days) was observed in treatment P_2 (No pinching) where as P_1(Pinching at 30 DAT) took maximum days for initiation of flowering (73.43 days after transplanting). The least days required for initiation of flowering (59.00 days) were recorded in T_5P_2 (GA_3 @ 200 ppm + no pinching). The minimum number of days required for flower opening from bud stage (5.17 days) was recorded in T_4 (GA_3 @ 100 ppm).

Keywords: Gaillardia, flowering, GA_3, pinching

Introduction
The gaillardia (*Gaillardia pulchella*) is mainly grown for its cut flowers and the loose flowers are used for making garlands in religious occasion and for decoration during social functions. It's gorgeously colored flowers are best arranged in copper bowls or simple plain-coloured vases. Gaillardia belongs to Asteraceae family. Local of southwestern united country and Mexico. It is popularly called 'blanket flower'. The common name may additionally seek advice from the resemblance of inflorescence to the brightly patterned blankets made via native people, or to the ability of wild taxa blanket the floor with colonies.

Several factors like, genetic, environment and management are influencing the successful commercial cultivation of the crop. However, the emphasis has given on the regulation of plant growth, yield and quality of flowers by using some plant growth regulators. Pinching is one of the cultural practice which is done 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) [13] The effect of such practices *viz*; use of plant growth regulator and pinching in the gaillardia flower production under various agroclimatic condition is a need to standardize the location specific package of practices. With this view the present investigation was carried out to assess the effect of plant growth regulator and pinching practice on flowering in gaillardia.

Material and Methods
The present investigation was carried out at Floriculture Farm of 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 coupled with piching practices and replicated three times. Seven treatments were tried with three growth regulators (Main factor)as T_1-Control, T_2-Ethephon @500ppm, T_3-Ethephon @ 1000 ppm, T_4-GA_3 @ 100 ppm, T_5-GA_3 @200 ppm, T_6-CCC @ 1000 ppm and T_7- CCC @ 2000ppm with pinching each consisting of two levels (Sub plot) as P_1 - Pincning at 30 days

after transplanting and P_2 - 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 carried out to manage the plot. 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 flowering characters *viz*; days to initiation of flowering, 50% flowering, days required for opening of flower from bud and flowering duration were recorded. The data were statistically analyzed by the method suggested by Panse and Sukhatme (1985) [10].

Results and Discussion

The data on days required for initiation of flowering and for 50% flowering as influenced by different plant growth regulators and pinching treatment are presented in Table 1.

Days required for initiation of flowering

Effect of Plant growth regulator

The data revealed that the development of flower primordial was greatly influenced by the growth regulators. The significantly early initiation of flowering (60.33DAT) was observed in treatment T_5 (GA_3 @ 200ppm). This treatment was followed the treatments T_4 (64.50 DAT, T_2 (69.17 DAT) and T_3 (73.33 DAT). Whereas in T_1 (Control), 75.17 days from transplanting were taken for initiation of flowering. The delayed initiation of flowering (81.83DAT) was observed in T_6 (CCC@1000ppm) treatment and it was followed by T_7 (CCC @ 2000ppm).The most primitive initiation of flowering was observed with the treatment of GA_3 which might be due to gibberellins which reduces juvenile period and with the termination of juvenile phase, the shoot apical meristem instead of producing leaves and branches start producing buds. The different concentrations (100 and 200 ppm) of GA_3 was effective regarding the earliness of first flowering, with the increase in GA_3 level, days to first flowering decreased progressively. Exogenous application of GA_3 may also favour the convenience factors influencing floral initiation i.e., carbohydrate pathway and photoperiodic pathway with GA_3 pathway. These results are in close accordance with Patil (2002) [12], Ghadage *et al.* (2013) [3] and Kadam *et al.* (2020) [5] in gaillardia.

Effect of pinching

The data revealed that the significantly early initiation of flowering (69.67DAT) was observed in treatment P_2 (No pinching) where as P_1(Pinching at 30 DAT) took maximum days for initiation of flowering (73.43 days after transplanting). The delayed in flowering by pinching was due to elimination of vegetative growth by cutting the growing tip and thereafter the additional time was taken to attain the physiological maturity of the crop for induction of flowering. Patade *et al.* (2020) [11] also observed delayed flowering in marigold due to pinching.

Interaction effect

The interaction between plant growth regulators and pinching exhibited significantly influenced the days required for initiation of flowering in gaillardia. The least days required for initiation of flowering (59.00 days) were recorded in T_5P_2 (GA_3 @ 200 ppm + no pinching) treatment and it was followed by T_5P_1 (GA_3 @ 200 ppm + pinching) treatment (61.67 days). The delayed flowering initiation (82.67DAT) was observed in T_6P_1 (CCC@1000ppm + pinching at 30 DAT). Early flowering owing to GA_3 may be due to gibberellins reduce juvenile period and delayed flowering in CCC with pinching attributed to delayed initiation of flowering.

Days required for 50% flowering

Effect of Plant growth regulator

The significantly least number of days required for 50% flowering (70.00 days) was taken in T_5 (GA_3@200ppm) and was followed by the treatment T_4 (73.33 days) and The maximum number of days (91.17 days) required for 50% flowering was in the treatment T_6 (CCC @ 1000ppm) and was followed by T_7 (85.17 days). However, the treatment CCC @ 2000ppm was at par with control (T_1). Earliness in attaining 50% flowering was in the plants treated withGA_3 treatment as compared to control and other treatments. It might be due to the fact that GA_3 application enhanced the translocation of food for development of floral primordial, which led to early flowering. Furthermore, this may be due to increased photosynthesis and respiration along with enhanced fixation by GA_3 that led to flower bud initiation. The results are in agreement with the findings by Kadam *et al.* (2020) [5] in gaillardia.

Effect of pinching

Pinching has significant influence on 50% flowering in gaillardia. The least days required for 50% flowering (79.00 days) was recorded in P_2 (no-pinching) while extended period for 50% flowering (82.81 days after transplanting) were taken in P_1 (pinching at 30 DAT). The delay in flowering in pinched plants might be due to the fact that new shoots which emerged after pinching entered into vegetative phase and took time to become physiologically mature to bear flowers. The observed results were in line with Ghormode *et al.* (2017) [4] in marigold.

Interaction effect

The interaction effect between plant growth regulator and pinching on 50% flowering of gaillardia was non-significant. Irrespective of treatments combination, on an average 80.90 days were required for 50% flowering in gaillardia.

Days to flower opening from bud stage

The data pertaining to the effect of plant growth regulators and pinching on days to flower opening from bud stage are presented in Table 2.

Effect of plant growth regulators

The data showed that the period of flower opening was also differed significantly and the minimum number of days required for flower opening from bud stage (5.17 days) was recorded in T_4 (GA_3@ 100 ppm) which was at par with the treatment T_5 (GA_3 @ 200ppm) i.e. 5.50 days and T_1 (Control) i.e. 5.83 days. The maximum number of days to flower opening from bud stage was observed in T_7 (CCC@ 2000 ppm) i.e.8.17days.

Less number of days required for flower bud opening in GA_3 treatment which might be due to more rapid cell development and elongation. The gibberellins induce different characteristics within the plants; as a result it might have also promoted formation of early buds as well as required minimum days for formation of bud to well-developed flower

for harvest. Whereas, growth retardants required more number of days for flower bud opening and the similar results were obtained by Moon *et al.* (2018) [8] where application of CCC resulted in maximum number of days required to opening of flower from bud initiation in gaillardia.

Effect of pinching

Influence of pinching on days required for opening of flower from bud was found non-significant. The findings suggest that there are no effects of pinching.

Interaction effect

The interaction effect between plant growth regulators and pinching on days required for opening of flower from bud in gaillardia was non-significant. The day required for opening of flower may be attributed with the previous season and environmental conditions.

Flowering duration

The data on flowering duration as influenced by the PGR treatments and pinching practices are presented in the Table 2.

Effect of plant growth regulators

The longest flowering duration (137.83 days) was observed in the treatment T_5(GA_3@ 200ppm) which was statistically at par with the treatment T_4 (GA_3 @100 ppm) having period of flowering duration (136.33 days). The shortest flowering duration (104.83) days) and (110.17) was observed in the treatment T_3 (Ethephon @1000ppm) and T_2 (Ethephon @ 500ppm).

Increase in duration of flowering might be due to advanced buds formation and stimulating flowering in GA_3 treated plants. These observations and findings in the present investigation are in conformity with those reported earlier by Dahiya and Rana (2001) [2] in Chrysanthemum and Kadam *et al.* (2020) [5] in Gaillardia.

Effect of pinching

Influence of pinching on flowering duration was found non-significant. Numerically maximum duration of flowering (121.38 days) was observed in P_1 (Pinching at 30 days after transplanting).

Interaction effect

The interaction effect between plant growth regulator and pinching significantly influenced on flowering duration of gaillardia. The longest flowering duration (138.33 days) was noted in theT_5P_1(GA_3@200ppm + Pinching at 30 DAT) followed by T_5P_2(GA_3 @ 200 ppm + No Pinching) and shortest 104.00 days duration of flowering was observed in T_3P_2 (Ehtephon @ 1000 ppm + No pinching).

An appraisal of the data clearly revealed that the application of GA_3 coupled with pinching at 30 DAT significantly extended the flowering span in gaillardia. It might be due to the fact that gibberellins induce the flowering in long day plants with specific day length requirement. Similar results were also obtained by Mohariya *et al.* (2003) [7]. On the other hand, the encouraging effect of pinching may be due to the fact that the removal of apical portion of the plant tends to enter into the juvenile phase and the new shoots take longer time to get physiological maturity, thus resulting longer duration of flowering. Similar findings were reported by Kumar *et al.* (2012) [6] and Badge *et al.* (2014) [1] in marigold. Shortest flowering duration with ethephon at 1000 ppm may be due to additive effect of ethylene on senescence. Namika *et al.* (2002) [9] reported that application of ethephonon in Chrysenthemum delayed flowering and extended duration of flowering.

From the present investigation, it is inferred that, plant growth regulators and pinching practice significantly altered the flowering in gaillardia and early initiation of flowering (60.33DAT) was observed in GA_3 @ 200ppm treatment.

Table 1: Effect on plant growth regulators and pinching on days required for initiation of flowering and 50% flowering of Gaillardia

Treatment combinations	Number of days required for initiation of flowering*			Number of days required for 50% flowering*		
	P_1	P_2	Mean	P_1	P_2	Mean
T_1	77.67	72.67	75.17	87.67	82.33	85.00
T_2	72.33	66.00	69.17	82.67	75.00	78.83
T_3	74.00	72.67	73.33	83.67	82.00	82.83
T_4	66.00	63.00	64.50	75.33	71.33	73.33
T_5	61.67	59.00	60.33	71.00	69.00	70.00
T_6	82.67	81.00	81.83	93.33	89.00	91.17
T_7	79.67	73.33	76.50	86.00	84.33	85.17
Mean	73.43	69.67	71.55	82.81	79.00	80.90
	S.Em ±	C.D at 5%	Result	S.Em±	C.D at 5%	Result
T	0.64	1.85	SIG	0.75	2.17	SIG
P	0.34	0.99	SIG	0.40	1.16	SIG
T x P	0.90	2.62	SIG	1.06	-	NS

* DAT–Days after transplanting

Table 2: Effect on plant growth regulators and pinching on days required for opening o flower from bud and flowering duration of Gaillardia

Treatment combinations	Days required for opening of flower from bud*			Flowering duration (Days)		
	P_1	P_1	P_1	P_1	P_2	Mean
T_1	6.00	5.67	5.83	119.00	122.00	120.50
T_2	8.33	7.33	7.83	112.00	108.33	110.17
T_3	6.67	6.33	6.50	105.67	104.00	104.83
T_4	4.67	5.67	5.17	135.67	137.00	136.33
T_5	5.33	5.67	5.50	138.33	137.33	137.83
T_6	7.67	7.33	7.50	117.33	116.00	116.67
T_7	8.67	7.67	8.17	121.67	121.00	121.33

Mean	6.76	6.52	6.64	121.38	120.81	121.10
	S.Em ±	C.D at 5%	Result	S.Em±	C.D at 5%	Result
T	0.38	1.10	SIG	0.64	1.85	SIG
P	0.20	-	NS	0.34	-	NS
T x P	0.53	-	NS	0.90	2.61	SIG

* DAT–Days after transplanting

PGRs Treatments:
1) T_1–Control
3) T_3 – Ethephon @ 1000 ppm
5) T_5 – GA3 @ 200 ppm
7) T_7 – CCC @ 2000 ppm

Pinching Treatments:
2) T_2 – Ethephon @ 500 ppm 1) P_1 - Pinching @ 30 DAT
4) T_4 – GA3 @ 100 ppm 2) P_2 – No pinching
6) T_6 – CCC @ 1000 ppm

References

1. Badge S, Panchbhai DM, Dod VN. The response of pinching and foliar application of gibberellic acid on growth and flower yield in summer African marigold. Research on Crops 2014;15(2):534-538.
2. Dahiya DS, Rana GS. Regulation of flowering in chrysanthemum as influenced by GA_3 and shade houses of different intensities. South Ind. Hort. 2001;49:313-314.
3. Ghadage PU, Raut PD, Golliwar VJ, Thakre SA. Effect of foliar application of different plant growth regulators on growth, yield and quality of gaillardia (var. Yellow Dusty). J Agric. Res. Tec 2013;38(1):42-46.
4. Ghormade GN, Gajbhiye RP, Borse GH, Moon SS. Growth and flowering of African marigold as influenced by pinching and Cycocel. Journal of soils and crops 2017;27(1):204-207.
5. Kadam MS, Malshe KV, Salvi BR, Chavan SS. Effect of plant growth regulators on flowering and flower yield in gaillardia (*Gaillardia pulchella)* cv. Local double. International Journal of chemical studies 2020;8(5):927-930.
6. Kumar V, Singh HK, Kumar A, Singh AK, Bhanupratap. Effect of planting distance and pinching on growth and flowering behavior of African marigold (*Tagetes erecta*) cv. Pusa Narangi Gainda in Rainy season. Current Advance Agriculture Science 2012;4(1):79-81.
7. Mohariya AD, Patil BN, Wankhede SG, Band PE, Bokey SP, Dorkar AR. Response of different varieties of chrysanthemum to growth regulators. Adv. Plant Sci 2003;16(1):143-146.
8. Moon SS, Masram GB, Dhepe VR, Gajbhiye RP. Growth and flowering of Gaillardia as influenced by pinching and cycocel. J. Soils and Crops 2018;28(1):152-156.
9. Namika A, Singh JSK, Sindhu. Effect of ethrel and Alar on Chrysanthemum. J ornamental Hort 2002;6(3):271-273.
10. Panse VG, Sukhatme PV. Statistical Methods for Agricultural Workers. I.C.A.R., New Delhi 1985.
11. Patade AA, Malshe KV, Sagvekar VV. Effect of pinching on flowering and yield in different varieties of marigold (*Tagetes spp*). J of Eco-friendly Agriculture 2020;15(1):29-32.
12. Patil AB. Effect of growth regulators on growth, flowering and flower yield of gaillardia. (*Gaillardia pulchella* Foug.) cv. 'Lorenziana'. M.Sc. (Agri.) thesis submitted to GAU, S. K. Nagar 2002.
13. Sehrawat SK, Dahiya DS, Sukhbir Singh, Rana GS. Effect of nitrogen and pinching on the growth, flowering and yield of marigold (*Tagetes erecta* L.) cv. African Gaint Double Orange. Haryana J Hort. Sci 2003;32(1, 2):59-61