J. Hortl. Sci.
Vol. 4 (1): 81-84, 2009

Short communication

Effect of different GA_3 concentration and frequency on growth, flowering and yield in Gaillardia (*Gaillardia pulchella* Foug.) cv. Lorenziana

D.V. Delvadia, T.R. Ahlawat and B.J. Meena
Department of Horticulture
Junagadh Agricultural University
Junagadh-362 001, India
E-mail: tahlawat@jau.in

ABSTRACT

The present experiment was conducted at the Horticultural Instructional Farm, Department of Horticulture, J.A.U., Junagadh during the winter 2004-05. The experiment comprised of ten treatments, viz., three concentrations of GA_3 (50, 150, 250 ppm) at three frequencies (single, double and triple spray at 30, 45 and 60 days from transplanting) and control. Each treatment was replicated thrice in randomized block design. Of the different treatments, GA_3 250 ppm single spray recorded maximum plant height and plant spread. Number of branches per plant was highest under double spray of GA_3 at 50 ppm. Longest flowering duration, maximum flower diameter and maximum shelf-life were observed with single spray of 250 ppm GA_3. It also registered maximum number and weight of flowers per plant besides highest flower yield.

Keywords: Gaillardia, GA_3, growth, flowering, yield

Of the various seasonal flowers, Gaillardia (*Gaillardia pulchella* Foug.) is an important flower crop of the *Asteraceae* family. It is commonly known as "Blanket Flower" and is a native of America. Gaillardia is fast gaining prominence as a commercial crop, owing to its wide adaptability to varying soil and climatic conditions, better resistance to pest and diseases, hardy nature, long duration of flowering and attractive flower colour. In the Saurashtra region of Gujarat, flowers of Gaillardia are extensively used in preparation of garlands and for decoration purpose during weddings, religious ceremonies, festivals and social gatherings. It is widely marketed as a loose flower and often as a substitute for marigold and chrysanthemum, whenever these flowers are in short supply or out of season. In recent years, idea of regulating plant growth, flower yield and quality by application of plant growth regulators has assumed significant importance. Therefore an attempt was made to study the response of Gaillardia to gibberellic acid at three different concentrations and frequencies.

The present experiment was conducted at the Horticultural Instructional Farm, Department of Horticulture, J.A.U., Junagadh during winter season of the year 2004-05. The experiment was laid out in a Randomized Block Design (RBD) with three replications and ten treatments including control. The treatments comprised of three concentrations of GA_3 (50, 150 and 250 ppm) and three frequencies single, double and triple sprays. GA_3 was sprayed thrice, starting from 30 days of transplantation and at 15 days intervals for second and third sprays. The seedlings of Gaillardia were transplanted at a spacing of 45 x 45 cm. Uniform cultural practices were followed to raise a good crop. Five plants were selected randomly from the net plot in each treatment and tagged for the purpose of recording different observations. Characters such as plant height, plant spread, number of branches per plant and shelf-life were recorded at full bloom stage. The duration from first flower opening to final harvesting was recorded as flowering span. Flower diameter was measured using Vernier caliper. Number and weight of flowers per plant was computed by summing up number and weight of flowers obtained during each plucking from randomly selected five plants. The data were expressed per plant. While flower yield was calculated by multiplying average weight of flower with total number of flowers per plant. The data thus generated were statistically analyzed.

Effect on growth parameters

Plant height was significantly influenced by GA_3 at all levels (Table 1). The maximum height was recorded with

a single spray and triple spray of GA_3 at 250 ppm (45.20 cm and 43.24 cm respectively). GA_3 was known to increase the plant height by influencing the internodal length, attributable to both cell division and cell elongation (Reddy and Sulladmath, 1983). Increased auxin content was reported due to the application of GA_3 and resulting in apical dominance, which may also have contributed to the increased plant height (Scott *et al*, 1967). Promotion in plant height as a consequence of GA_3 application was earlier reported by Makwana (1999) in Gaillardia.

A somewhat similar trend was observed in plant spread where all treatments registered a significant increase in plant spread over control. A single spray of GA_3 at 250 ppm registered the maximum plant spread (39.10 cm). According to Verma (1991) it was due to the formation of new cells in meristematic region and an increase in size and mass of cells produced. Similar findings were also reported by Singh *et al* (1991) in marigold.

A significant increase in number of branches per plant was observed with the application of a single spray of GA_3 at 250 ppm, double spray of GA_3 at 50, 150 and 250 ppm and a triple spray of GA_3 at 150 and 250 ppm. Of the above treatments, GA_3 50 ppm double spray yielded the highest number of branches per plant (24.33). Increase in the number of branches with GA_3 treatment may be due to the hyper elongation of internodal length and a resultant increase in nodal count on the main axis. Consequently these nodes increased number of dormant buds from where the primary branches may have originated (Krishna Kumar and Ughreja, 1998). This confirms the report on an increase in number of branches with GA_3 application in Gaillardia by Patel (1998).

Table 1. Effect of various GA_3 concentrations and frequencies on vegetative growth in Gaillardia

Treatment	Plant height at full bloom (cm)	Plant spread at full bloom (cm)	No. of branches/ plant
T_1 GA_3 50 ppm single	25.40	35.60	15.00
T_2 GA_3 150 ppm single	34.25	37.96	13.68
T_3 GA_3 250 ppm single	45.20	39.10	16.68
T_4 GA_3 50 ppm double	39.80	27.96	24.33
T_5 GA_3 150 ppm double	39.89	22.13	19.68
T_6 GA_3 250 ppm double	41.54	29.06	17.00
T_7 GA_3 50 ppm triple	39.60	26.83	11.33
T_8 GA_3 150 ppm triple	42.42	24.87	15.68
T_9 GA_3 250 ppm triple	43.24	29.90	19.67
T_{10} Control	22.96	20.10	12.00
S. Em $\pm$	0.82	0.68	1.04
C. D. (*P = 0.05*)	2.44	2.02	3.10
C. V. %	3.61	4.14	10.64

Effect on flowering traits

The influence of varying GA_3 levels on flowering traits and shelf-life of Gaillardia indicated significant differences in the flowering span, flower diameter and shelf life as affected by various treatments (Table 2).

GA_3 250 ppm single spray, GA_3 50 ppm double spray and GA_3 250 ppm triple spray recorded a significant increase in flowering span. Advanced bud formation and onset of flowering in GA_3 treated plants was attributed to enhanced flowering duration (Dutta *et al*, 1993). Prolonged flowering duration owing to GA_3 was also documented by Dahiya and Rana (2001) in chrysanthemum.

A 250 ppm single spray, 250 ppm triple spray, 150 and 50 ppm single spray of GA_3 showed a significant increase in flower diameter over control. They were all at par with each other. The enlargement in flower size is caused by drawing of photosynthates to the flower as a consequence of increased sink activity (Zieslin *et al*, 1974). According to Dutta *et al* (1993) the enhancement in flower size might be due to an increase in the length of the petals and pedicels accompanied by increased number of petals. It is in conformity with the observations of Meher *et al* (1999) in chrysanthemum.

A single spray of GA_3 at 150 and 250 ppm significantly enhanced the shelf-life of flowers. These treatments were at par with each other. The maximum shelf life (72.80 h) was observed when the plants were subjected to a single spray of GA_3 at 250 ppm. GA_3 reduces water loss and has anti-senescence properties leading to enhanced shelf-life of flowers (Singh *et al*, 1994). Similar results were

Table 2. Effect of varying GA_3 levels and frequencies on flowering traits and shelf life in Gaillardia

Treatment	Flowering span (days)	Flower diameter (cm)	Shelf-life of loose flowers (hours)
T_1 GA_3 50 ppm single	80.33	5.85	68.20
T_2 GA_3 150 ppm single	75.00	5.86	71.10
T_3 GA_3 250 ppm single	91.33	6.30	72.80
T_4 GA_3 50 ppm double	86.00	5.75	63.33
T_5 GA_3 150 ppm double	71.66	5.55	65.80
T_6 GA_3 250 ppm double	63.33	5.49	60.73
T_7 GA_3 50 ppm triple	58.33	5.67	69.43
T_8 GA_3 150 ppm triple	74.66	5.71	70.40
T_9 GA_3 250 ppm triple	85.33	5.95	67.87
T_{10} Control	73.33	5.32	68.10
S. Em $\pm$	3.38	0.12	0.90
C. D. (*P = 0.05*)	7.06	0.50	2.72
C. V. %	5.42	5.20	4.05

also reported by Dutta and Seemanthini (1998) in chrysanthemum.

Effect on yield characters

Significant differences in flower yield and its associated traits were observed with application of GA_3 (Table 3). With the sole exception of GA_3 250 ppm double spray, all other treatments recorded a significant increase in number of flowers over control. Maximum numbers of flowers (150.48) were observed with a single spray of GA_3 at 250 ppm.

This is attributed to the production of large number of laterals at an early stage of growth, which then had sufficient time to accumulate reserve carbohydrates for proper flower bud differentiation (Dutta *et al*, 1993). Increasing number of flowers per plant was observed because of the production of large number of branches and more plant spread due to GA_3 application. This result finds support from the findings of Poshiya *et al* (1995) in Gaillardia.

All treatments proved significantly superior over control in increasing weight of flowers per plant. Single spray of GA_3 at 250 ppm registered the highest flower weight (341.60 g). This treatment was at par with a single spray of GA_3 at 50 and 150 ppm, a double spray of GA_3 50 ppm and a triple spray of GA_3 at 150 ppm. Increase in weight of flowers per plant with GA_3 may be attributed to the production of more number of flowers with larger size and more florets. Dehale *et al* (1993) also observed similar results in chrysanthemum with GA_3 application.

A significant increase in flower yield was observed by the application of GA_3 at all levels. A single spray of GA_3 at 250 ppm recorded the highest flower yield (18.06 t/ha). The increase in flower yield was due to the production of more number of flowers per plant and improvement in weight of flowers per plant. Similar results were reported by Pandya (2000) in marigold.

It can thus be inferred that a single spray of GA_3 at 250 ppm was found best for optimum growth and production of Gaillardia flowers under South Saurashtra conditions of Gujarat.

Table 3. Effect of different GA_3 levels and frequencies on yield characters in Gaillardia

Treatment	No. of flowersper plant	Total weight of flowersper plant(g)	Flower yield (t/ha)
T_1 GA_3 50 ppm single	120.20	320.20	15.68
T_2 GA_3 150 ppm single	131.80	323.90	16.08
T_3 GA_3 250 ppm single	150.48	341.60	18.06
T_4 GA_3 50 ppm double	104.53	319.80	15.09
T_5 GA_3 150 ppm double	97.25	290.10	14.21
T_6 GA_3 250 ppm double	91.30	288.03	14.06
T_7 GA_3 50 ppm triple	110.67	312.93	15.35
T_8 GA_3 150 ppm triple	122.10	323.10	15.85
T_9 GA_3 250 ppm triple	102.93	312.43	15.52
T_{10} Control	82.20	259.50	12.51
S. Em $\pm$	3.14	9.53	0.41
C. D. (*P = 0.05*)	10.14	28.10	1.33
C. V. %	5.32	5.18	5.10

REFERENCES

Dahiya, D.S. and Rana, G.S. 2001. Regulation of flowering in chrysanthemum as influenced by GA_3 and shade-houses of different intensities. *South Ind. Hort*., **49**:313-314

Dehale, M.H., Deshmukh, P.P. and Moharkar, V.K. 1993. Influence of foliar application of GA_3 on quality of chrysanthemum. *J. Soils and Crops*, **3**:135-137

Dutta, J.P. and Seemanthini, R. 1998. Growth and flowering response of chrysanthemum (*Dendranthema grandiflora* cv. Tzvelev.) to growth regulator treatments. *Orissa J. Hort*., **26**:70-75

Dutta, J.P., Seemanthini, Ramdas and Khader. A.M.D. 1993. Regulation of flowering by growth regulators in chrysanthemum (*Chrysanthemum indicum* L.) cv. CO-1. *South Ind. Hort*., **41**:293-299

Krishna Kumar and Ughreja, P.P. 1998. Effect of foliar application of GA_3, NAA, MH and Ethrel on growth, flowering and yield of chrysanthemum (*Chrysanthemum morifolium* Ram.) cv. IIHR-6. *J. Applied Hort*., **4**:20-26

Makwana, M.K. 1999. The effect of plant growth regulators on growth, yield and quality of gaillardia (*Gaillardia pulchella*) cv. Lorenziana. M.Sc. (Agri.) thesis, GAU, Sardar Krushinagar

Meher, S. P., Jitode, D.J., Turkhede, A.B., Darange, S.O., Ghatol, P.U. and Dhawad, C.S. 1999. Effect of planting time and growth regulator treatments on flowering and yield of chrysanthemum (*Chrysanthemum morifolium* Ramat). *Crop Res*., **18**:345-348

Pandya, P.N. 2000. Effect of plant growth regulators on growth, yield and vase life of African marigold (*Tagetes erecta* L.) cv. Lemon Yellow. M. Sc. thesis GAU, Sardar Krushinagar

Patel, S.L. 1998. Effect of plant growth regulators on growth, flowering and flower yield of annual (*Gaillardia pulchella*) var. Lorenziana. M.Sc. (Agri). thesis, GAU, Sardar Krushinagar

Poshiya, V.K., Katariya, G.K. and Chovatia V.P. 1995. Effect of growth substances on growth and yield in gaillardia. *J. Applied Hort.*, **1**:99-100

Reddy, Y.T.N. and Sulladmath, U.V. 1983. Effect of growth regulators on growth and flowering of China aster (*Callistephus chinensis* Nees). *South Ind. Hort.*, **31**:95-98

Scott, T.K., Case, D.B. and Jacobs W.P. 1967. Auxin gibberellin interaction in apical dominance. *Pl. Physiol.*, **42**:1329-1333

Singh, J.N., Singh, D.K. and Sharma K.K. 1994. Effect of GA_3 and alar on growth, flowering and seed production of dahlia (*Dahlia variabilis* L.) *Orissa J. Hort*., **22**:10-12

Singh, M.P., Singh, R.P. and Singh, G.N. 1991. Effect of GA_3 and ethrel on the growth and flowering of African marigold (*Tagetes erecta* L.). *Har. J. Hortl. Sci*., **2**:81-84

Verma, V. 1991. "A Text Book of Plant Physiology". Emkay Publications, Delhi. 518p

Zieslin, N., Brian, I. and Halevy, A.H. 1974. The effect of growth regulators on growth and pigmentation of Baccara rose flowers. *Pl. Cell Physiol.*, **15**:341-349

(MS Received 19 August 2008, Revised 4 March 2009)