Int.J.Curr.Microbiol.App.Sci (2017) *6*(8): 116-121

EXCELLENT PUBLISHERS

International Journal of Current Microbiology and Applied Sciences
ISSN: 2319-7706 **Volume 6 Number 8 (2017) pp. 116-121**
Journal homepage: http://www.ijcmas.com

Original Research Article https://doi.org/10.20546/ijcmas.2017.608.015

Effect of Plant Growth Regulators on Growth and Flowering of Pomegranate (*Punica granatum* L.) Cv. Kandhari in Allahabad Agro-Climatic Conditions

Trustful Phawa*, V.M. Prasad and V.B. Rajwade

Department of Horticulture, Naini Agricultural Institute, Sam Higginbottom University of Agriculture, Technology and Sciences, Allahabad, Uttar Pradesh, India
**Corresponding author*

Keywords

Pomegranate, Growth regulators, Vegetative growth, Flowering.

Article Info

Accepted:
04 June 2017
Available Online:
10 August 2017

ABSTRACT

A field experiment was conducted to investigate the "Effect of Plant Growth Regulators on Growth and Flowering of Pomegranate (*Punica granatum* L.) cv. Kandhari in Allahabad Agro-Climatic Conditions" at Horticulture Research Farm, Department of Horticulture, Naini Agricultural Institute, Sam Higginbottom University of Agriculture, Technology and Sciences, Allahabad (U.P) during the year 2016-2017. The experiment consisted of 10 treatments with three replications laid out in Randomized Block Design. The growth regulators applied were NAA (20 ppm, 30 ppm, 40 ppm), GA_3 (25 ppm, 50 ppm, 75 ppm), 2, 4-D (20 ppm, 30 ppm, 40 ppm). Control plants were fed no growth regulators. The results revealed that application of GA_3 at 75 ppm showed maximum plant height (194.90 cm), spread of plant (194.20 cm), canopy volume (3.81 m^3), internode length (8.07 cm), shoot length (15.57 cm), plant girth (3.24 cm), leaf area (7.37 cm^2), and number of flowers per plant (29.01). The minimum days to flowering (23.67) were recorded under 40 ppm NAA.

Introduction

Pomegranate (*Punica granatum* L.) is one of the oldest known edible fruits and is capable of growing in different agro-climatic conditions ranging from the tropical to sub-tropical (Levin, 2006; Jalikop, 2007). It belongs to the genus Punica and family Punicaceae (Chatterjee and Randhawa, 1952). It is grown for its delicious and juicy pink aril (outer growth of seed) which is eaten fresh (Keskar *et al.,* 1993). Pomegranate is an ancient fruit originated in South-west Asia, probably in Iran and some adjoining countries (De Candolle, 1967). Plant growth regulators have remained an important component in horticulture from time immemorial because they were effective means of quantitative as well as qualitative improvement in growth and development of crops. Plant growth and development as well as the responses to environmental factors, are highly regulated by complex and coordinated action of the endogenous hormones. Plant growth regulators are reported to play a significant role in pomegranate (Chaudhari and Desai, 1993). Different group of plant growth regulators like auxins, gibberellins and growth retardants at varuous-concentrations have been reported to influence flowering, fruit set, fruit retention, development and quality characters of several fruit crops (Bhujbal *et al.*, 2013). The present study was therefore, carried out to find the suitability of the plant growth regulators on the vegetative growth and flowering of pomegranate.

Materials and Methods

The field experiment was conducted during the year 2016-2017 at Horticulture Research Farm, Department of Horticulture, Naini Agricultural Institute, Sam Higginbottom University of Agriculture, Technology and Sciences, Allahabad (U.P). The experiment consisted of 10 treatments with three replications laid out in Randomized Block Design.

The growth regulators applied were NAA (20 ppm, 30 ppm, 40 ppm), GA_3 (25 ppm, 50 ppm, 75 ppm), 2, 4-D (20 ppm, 30 ppm, 40 ppm). Control plants were fed no growth regulators. Four years old pomegranate trees of cv. Kandhari with uniform vigour and size, planted at a spacing of 5m x 5m were selected.

All plants were given uniform cultural practices during the period of investigation. The solutions of plant growth regulators were prepared by dissolving them in small quantity of ethanol and made up the volume by the addition of distilled water and sprayed with the help of Knapsack sprayer.

The plant growth regulators were sprayed on the plants till the leaves / twigs were wet and droplets of solutions started trickling down. The observations were recorded on three randomly selected plants of each treatment. Observations were recorded at 30 days interval regularly for each replications and treatments on vegetative growth and flowering parameters of pomegranate. The data recorded was analyzed using the statistical procedure as described by Gomez and Gomez (1984).

Results and Discussion

The results obtained from the present investigation are summarized below:

Effect on plant height

The application of different level of growth regulators significantly affected the plant height of pomegranate. The maximum plant height (194.90 cm) was recorded at 75ppm GA_3 followed by 50 ppm GA_3 (192.47 cm). The minimum plant height (164.17 cm) was recorded in control (Table 1). The effectiveness of GA_3 might be due to its role in promoting growth and stimulated the rapid cell elongation in meristematic zone of vegetative plant organs. The improvement of the length of plant was due to both increased number and length of cells. The result is in conformity with the earlier report by Bhogave and Raut (2014) in papaya, Saima *et al.*, (2014) in strawberry and Digrase *et al.*, (2016) in pomegranate.

Effect on plant spread

The plant spread increased significantly by various treatments. Maximum plant spread (194.20 cm) was found in 75 ppm GA_3 treatment while it was minimum (173.57 cm) under control (Table 1).

The maximum increase in plant spread with the spray of GA_3 might be due to beneficial effect of GA_3 in cell elongation and enlargement. The increased uptake of water and nutrients due to persuasive swelling forces leading the softening of cell wall and thereby favoured better development of plants resulting in greater height and number of branches per plant and ultimately the greater plant spread. These results are in close conformity with those reported by Kacha *et al.*, (2012) in phalsa and Kumar *et al.*, (2012) in strawberry.

Effect on canopy volume

The application of different level of growth regulators significantly affected the canopy volume of pomegranate. The maximum canopy volume (3.81 m^3) was recorded with the application of 75ppm GA_3 followed by 50 ppm GA_3 (3.68 m^3). The minimum canopy volume (2.83 m^3) was recorded in control (Table 1). The maximum increase in canopy volume with the spray of GA_3 might be due to beneficial effect of GA_3 in cell elongation and enlargement. The increased uptake of water and nutrients due to persuasive swelling forces leading the softening of cell wall and thereby favoured better development of plants resulting in greater height and spread of plant and ultimately the greater canopy volume. The present findings are in accordance with the report of Eelkim *et al.*, (2003) in mandarin, Sharma (2004) in apple, Saleem *et al.*, (2007) in sweet orange and Kumar *et al.*, (2012) in strawberry.

Effect on internode length

After examining the data regarding internode length (Table 1), a significant increase was observed in internode length under various treatments as compared with control. Maximum internode length (8.07 cm) was observed in plants treated with 75 ppm GA_3 and it was followed by 50 ppm GA_3 (7.84 cm). The minimum internode length (5.51 cm) was recorded in control.

Higher inter-nodal length achieved might be due to cell division and cell elongation growth enhancing properties of gibberellin as reported by Mahmoud (1989) in grapes, Kumar *et al.*, (2014) in phalsa and Singh *et al.*, (2015) in phalsa.

Table.1 Effect of plant growth regulators on vegetative growth and flowering of Pomegranate cv. Kandhari

Treatments	Plant height (cm)	Plant spread (cm)	Canopy volume (m^3)	Internode length (cm)	Shoot length (cm)	Plant girth (cm)	Leaf area (cm^2)	Number of flowers	Days to flowering
Control	179.57	173.57	2.83	5.51	11.53	2.60	6.03	21.13	26.21
NAA 20 ppm	183.20	182.03	3.14	6.72	13.97	2.91	6.57	26.37	23.96
NAA 30 ppm	185.90	183.90	3.26	6.97	14.33	2.99	6.73	26.98	23.82
NAA 40 ppm	188.13	186.93	3.41	7.28	14.97	3.08	7.00	28.58	23.67
GA_3 25 ppm	190.13	189.97	3.55	7.61	15.17	3.21	7.13	27.53	23.78
GA_3 50 ppm	192.47	192.00	3.68	7.84	15.33	3.29	7.27	27.87	24.07
GA_3 75 ppm	194.90	194.20	3.81	8.07	15.57	3.34	7.37	29.01	24.31
2,4-D 20 ppm	182.97	174.20	2.90	6.40	12.30	2.67	6.10	24.26	24.78
2,4-D 30 ppm	184.00	177.07	3.01	6.11	12.67	2.73	6.23	25.37	24.84
2,4-D 40 ppm	186.03	180.03	3.12	5.83	13.47	2.81	6.43	25.93	24.98
C.D. (P=0.05)	4.06	9.35	0.29	0.54	1.33	-	0.43	1.82	1.08

Effect on shoot length

Plant growth regulators spray significantly affect the shoot length. However, the maximum shoot length (15.57 cm) was measured with foliar spray of 75 ppm GA_3 followed by spray of 50 ppm GA_3 (15.33 cm) and minimum was recorded in control (Table

1). The increase in vegetative growth of the plant with the spray of plant growth regulators may be attributed to the association of nitrogen in the synthesis of protoplasm and in the primary manufacture of amino acids and increased auxin activities. As a result, meristematic activities increased which in turn increase the vegetative growth. Similar results have also been reported by Kumar *et al.,* (2014) in phalsa and Karole and Tiwari (2016) with spray of NAA + GA_3 + Urea in ber.

Effect on plant girth

Plant girth showed a non-significant effect by the application of different level of growth regulators. Maximum plant girth (3.34 cm) was recorded in plants treated with 75 ppm GA_3 and it was followed by treatment 50 ppm GA_3 (3.29 cm).The minimum plant girth (2.60 cm) was recorded in control (Table 1). The maximum increase in plant girth due to GA_3 application might be due to fact that gibberellins regulate the growth of plants by causing cell division and cell elongation, thereby increasing the vegetative growth by overcoming genetic dwarfism (Singh and Singh 2009). Similar observations have been reported by Jadhav *et al.,* (2006) and Kaur and Kaur (2015).

Effect on leaf area

The results of the present study showed that the application of growth regulators significantly affected the leaf area. It was observed that plants treated with 75 ppm GA_3 produced maximum leaf area (7.37 cm^2) and it was followed by 50 ppm GA_3 treatment (7.27 cm^2). The minimum leaf area (6.03 cm^2) was recorded in control (Table 1).

The increase in leaf area was probably due to the fact that gibberellin stimulates the activity of auxin resulting in production of more number of leaves thereby increasing leaf area. These results confirmed the findings of Mahmoud (1989) in grapes, Paroussi (2002) in strawberry and Saima *et al.,* (2014) in strawberry as they also reported the positive role of GA3 in enhancing leaf area.

Effect on number of flowers

The results summarized in table 1 showed that, the application of different plant growth regulator had significant effects on number of flowers per plant. The maximum number of flowers (29.01) was recorded with the application of 75ppm GA_3 followed by 40ppm NAA (28.58). The minimum number of flowers (21.13) was recorded in control. Increase in number of flowers following GA_3 application might be due to fact that the plants sprayed with GA_3 and NAA remained physiologically more active to build up sufficient food reserve for developing flowers. Auxins are also known to stimulate flower bud initiation. Hence, the increase in flowering may be due to enhanced photosynthesis which increased the potential of trees to develop more flower buds. Similar observations have been reported by Singh and Singh (2006) in strawberry, Kappel and MacDonald (2007) in sweet cherry and Bhogave and Raut (2014) in papaya.

Effect on days to flowering

The application of different level of growth regulators significantly affected the days to flowering of pomegranate. The minimum days to flowering (23.67) was recorded in 40 ppm NAA while the maximum days to flowering (26.21) was recorded in control (Table 1). The result on earliness in flowering in this experiment goes with the reports by Kannan *et al.,* (2009) in paprika and Bhujbal *et al.,* (2013) in sapota who reported that the application of NAA produced significantly minimum number of days for flower initiation.

References

Bhogave, A.F. and Raut, U.A. (2014) Studies on effect of plant growth regulators on vegetative growth and flowering of papaya. *Ecology, Environment and Conservation Journal*. 21: 387-390.

Bhujbal, D.S., Naik, D.M. and Kale, S.A. (2013) Studies on effect of growth regulators on flowering, fruiting and quality of sapota. *Int J Ag Sci*. 9(1): 289-292.

Chatterjee, D. and Randhawa, G.S. (1952) Standardized name of cultivated plants in India. *Indian Journal of Horticulture.* 9: 24-36.

Chaudhari, S.M. and Desai, U.T. (1993) Effect of plant growth regulators on flower sex in pomegranate. *Ind. J. Agril. Sci.* 63: 34-35.

De–Candolle, A. (1967) Orgin of Cultivated Plants, pp: 237–240. Hafner Publication, Co. New York and London.

Digrase, S.S., Tambe, T.B., Kadam, A.S. and Kalalbandi, B.M. (2016) Effect of different plant growth regulators and chemicals on growth and yield of pomegranate (*Punica granatum* L.) cv. Bhagwa. *Adv. Res. J. Crop Improv*. 7 (1): 96-99.

EelKim, M.Y., HoKim, Y., Kho, C.M. and SangOok. (2003) Effects of foliar application of GA3 on flowering and fruit quality of very early-maturing satsuma mandarin. *Korean J. Hort. Sci. & Tec.* 21(2): 110-113.

F. Kappel and MacDonald, R. (2007) "Early gibberellic acid spray increase fruiting and fruit size of Sweetheart sweet cherry," J. Am. Pomol. Soc, 61(1), pp 38–43.

Gomez, K.A. and Gomez, A.A. (1984) Statistical procedure for agricultural research (2nd Ed.), John Willey and Sons Inc, New York, 680p.

Jadhav, S.B., Dhutraj, D.N. and Bastewed, T.B. (2006) Effect of growth regulators and urea sprays on growth of Rangpur lime seedling. *Journal of Mahrashtra Agricultural Univerisities.* 31(1): 82-84.

Jalikop, S. H. (2007) Linked dominant alleles of inter-locus interaction results in a major shift in pomegranate fruit acidity of 'Ganesh' and 'Kabul Yellow'. *Euphytica.* 158: 201-207.

Kacha, H.L., Viradia, R.R., Leva, H.M., Jat, G. and Tank, A.K. (2012) Effect of NAA. GA3 and ethrel on yield and quality of phalsa under South-Saurashtra condition. *Asian J. Hort.* 7(2): 242-245.

Kannan, K., Jawaharlal, M. and Prabhu, M. (2009) Effect of plant growth regulators on growth and yield parameters of paprika cv. KtPl-19. *Agric. Sci. Digest*. 29(3): 157-162.

Karole,B. And Tiwari,R.(2016) Effect of pre growth regulators and urea on growth, yield and quality of ber under malwa plateau conditions, Annals of Plant and Soil Research 18(1):18-22.

Kaur, G. and Kaur, A. (2015) Plant growth and fruit yield attributes of Cape gooseberry cv. Aligarh as affected by the use of different growth regulators. *Agric. Sci. Digest*. 36(2): 138-141.

Keskar, B.G., Karale, A.R. and Kale, P.N. (1993) Improvement of pomegranate. In: Advance in Horticulture Vol. I (Eds. K. L. Chadha and O. P. Pareek), Malhotra Publishing House, New Delhi, pp 399-405.

Kumar, R., Bakshi, M. and Singh, D.B. (2012) Influence of plant growth regulators on growth, yield and quality of strawberrry (*Fragaria x Ananassa* Duch.) under U.P. Sub tropics. *Asian J. Hort*. 7(2): 434-436.

Kumar, S., Yadav, A. L., Vishwakarma, G. and Yadav, D. K. (2014) Effect of foliar feeding of nutrients and plant growth regulators on vegetative growth and yield of phalsa (*Grewia subinaequalis* D.C.). *Res. Environ. Life Sci*. 7(4): 293-294.

Levin, G.M. (2006) Pomegranate (Ist Edn), Third Millennium Publishing, East Libra Drive Tempe, AZ, pp 13-120.

Mahmoud, H.M. (1989) the effect of GA3 and B-9 on the berry physical and chemical properties in “While Banaty” Seedless Grapevines. *Assiut J. Agri. Sci*. 20: 13-22.

Paroussi, G., Voyiatzis, D.G., Paroussis, E., Drogoudi, P.D., Hietaranta, T., Linna, M.M., Palonen, P. and Parikka, P. (2002) Proceedings of the Fourth International Strawberry Symposium, Tampere, Finland, July 9-14, 2000, volume 1. *Acta Horticulturae* 1: 273-276.

Saima, Z., Sharma, A., Umar, I. and Wali, V.K. (2014) Effect of plant bio-regulators on vegetative growth, yield and quality of strawberry cv. Chandler. *African Journal of Agricultural Research*. 9(22): 1694-1699.

Saleem, B.A., Malik, A.U. and Farooq, M. (2007) Effect of exogenous growth regulators application on June fruit drop and fruit quality in *Citrus sinensis* cv. Blood Red. *Pakistan J. Agri. Sci*. 44(2): 289-294.

Sharma, G. (2004) Effect of environmental conditions, nutrient, plant growth regulator applications and orchard floor management practices on flowering, fruit set, yield and quality in apple. Ph.D. Thesis, Dr Y S Parmar University of Horticulture and Forestry, Nauni, Solan, H.P. India.

Singh, A. and Singh, J.N. (2006) Studies on the influence of biofertilizers and bioregulators on flowering, yield and fruit quality of strawberry Cv. Sweet Charlie. *Ann. Agri. Res*. 27(3): 261–264.

Singh, A. and Singh, J.N. (2009) Effect of biofertilizers and bioregulators on growth, yield and nutrient status of strawberry cv. Sweet Charlie. *Indian Journal of Horticulture*. 66: 220-224.

Singh, A.K., Kumar, A. and Yadav, A.L. (2015) Effect of pruning intensity, foliar feeding of P.G.R. and micro nutrients on physico-chemical attributes of phalsa (*Grewia subinaequalis* D.C.) fruits. *Res. Environ. Life Sci*. 8(4): 675-678.

How to cite this article:

Trustful Phawa, V.M. Prasad and Rajwade, V.B. 2017. Effect of Plant Growth Regulators on Growth and Flowering of Pomegranate (*Punica granatum* L.) Cv. Kandhari in Allahabad Agro-Climatic Conditions. *Int.J.Curr.Microbiol.App.Sci*. 6(8): 116-121.
doi: https://doi.org/10.20546/ijcmas.2017.608.015