Journal of Pharmacognosy and Phytochemistry

Available online at www.phytojournal.com

E-ISSN: 2278-4136
P-ISSN: 2349-8234
JPP 2019; 8(4): 979-981
Received: 07-05-2019
Accepted: 09-06-2019

Gollagi SG
Assistant Professor of Crop Physiology, University of Horticultural Sciences, Bagalkot, Karnataka, India

Lokesha R
Research Scholar, Department of Fruit Science, University of Horticultural Sciences, Udyanagiri, Bagalkot, Karnataka, India

Dharmpal Singh
Research Scholar, Department of Fruit Science, University of Horticultural Sciences, Udyanagiri, Bagalkot, Karnataka, India

Sathish BR
Research Scholar, Department of Fruit Science, University of Horticultural Sciences, Udyanagiri, Bagalkot, Karnataka, India

Correspondence
Gollagi SG
Assistant Professor of Crop Physiology, University of Horticultural Sciences, Bagalkot, Karnataka, India

Effects of growth regulators on growth, yield and quality of fruit crops: A review

Gollagi SG, Lokesha R, Dharmpal Singh and Sathish BR

Abstract
The plant growth regulators are chemical compounds, which can regulate some important metabolic activities in plants. They influence on growth and development of plants, which influence the increase in yield, quality of product, flowering and some other parameters. Plant growth regulators include auxins, gibberellins, cytokinins, ethylene, growth retardants and growth inhibitors. Production of low quality fruits is a common experience therefore, to improve the yield and quality of fruit crops application of growth regulators is one of the important production strategy.

Keywords: Growth regulator, fruit, yield and quality

1. Introduction
Plant growth regulators or phytohormones are organic substances produced naturally in higher plants, controlling growth or other physiological functions at a site remote from its place of production and active in minute amounts. PGRs can influence plant height, leaf number, leaf area index, dry mass, chlorophyll content, photosynthetic parameters, seed yield, oil yield, nutritional status *etc*. Among different elite horticultural practices, growth regulators have been advantageously used in the recent time to increase the fruit production and to improve the quality of several other fruit crops. Plant growth regulators include auxins, gibberellins, cytokinins, ethylene, growth retardants and growth inhibitors.

2. Class of plant growth regulators
Auxins: IAA, NAA, IBA, 2-4D, 4- CPA
Gibberellins: GA3
Cytokinins: Kinetin, Zeatin
Ethylene: Ethereal
Abscissic acid: Dormins, Phaseic Acid
Phenolic substances: Coumarin
Flowering hormones: Florigin, Anthesin, Vernalin
Natural substances: Vitamins, Phytochrome Tranmatic
Synthetic substances: Synthetic Auxins, Synthetic Cytokinins
Growth inhibitors: AMO-1618, Phosphon-D, Cycosel, B-999.

3. Effects of growth regulator on growth and flowering of fruit crops
In majority of fruit plants, fruit drop is controlled by spraying of NAA in different concentrations. It is applied after blossom fertilization (Suman *et al*., 2017) [24]. Devnath and Kundu (2001) [6] reported that NAA 200 ppm and 400 ppm increased the number of new shoots in mango cv. Himsagar when applied twice in the middle of August and October.
Singh and Singh (2005) [21] treated the strawberry cultivar Sweet Charlie with NAA at 50 ppm and 100 ppm and observed significant increase in flower numbers with the application of 100 ppm NAA. Goswami *et al.* (2013) [9] revealed that application of NAA 50 ppm was found effective in increasing the number of stem at the time of pruning and also the number of hermaphrodite flowers per plant, Similarly, highest size of male, intermediate and hermaphrodite flowers was observed by the application of NAA 100 ppm, which was also at par with NAA 50 ppm in pomegranate (Anawal *et al.*, 2015) [3].
Singh (2008) [22] revealed that application of 400 ppm GA_3 significantly increased shoot growth, tree height and spread in pomegranate cv. G-137. Perez *et al.* (2009) [14] recorded highest leaf number in strawberry cv. Chandler with an exogenous application of GA_3. Similarly, the application of GA_3 at 100 ppm resulted in maximum number of runners and leaf area in the strawberry cv. Merak (Saied *et al.*, 2012) [16].

Application of GA_3 resulted the dropping of intermediate flowers in pomegranate cv. Bhagwa (Anawal *et al.*, 2015) [3], however, GA_3 75 ppm marked the maximum height and spread of pomegranate plant (Digrase *et al*., 2016) [7].

Application of 10 ppm BA increased chlorophyll content in pear cv. Baggugosha (Singh, 2004) [23]. However, Digrase *et al*. (2016) [7] could not observe any significant differences regarding the height and spread of pomegranate plant following the 6-BA 5 ppm application.

Sharma and Ananda (2004) [17] recorded significantly higher increase in leaf area and vegetative growth in Starking Delicious with the application of 10 ppm GA_3 + 5 ppm BA. Sharma (2004) [18] found that application of 10 ppm GA_3 + 5 ppm BA + 5 ppm NAA, significantly increased the trunk cross-sectional area, tree volume and shoot growth in apple cv. Starking Delicious. Momenpour *et al*. (2009) [12] conducted an experiment on strawberry cultivars (Pajaro, Queen Eliza and Paros) sprayed during April and June with the mixture of BA 1200 ppm and GA_3 300 ppm and recorded the highest number of runners and maximum leaf number

4. Effect of plant growth regulators on fruit yield

Higher fruit yield was recorded in Eureka lemon following the foliar spray of NAA at 40 ppm and 20 ppm (Bhat *et al*., 2006) [4]. Vejendla *et al.* (2008) [26] observed that NAA applications reduced flowers drop, and gave high flowers retention and increased yield as well as improved fruit quality of mango. Anawal *et al.* (2016) [2] while studying the effect of plant growth regulators in pomegranate cv. Bhagwa noticed that application of NAA 40 ppm at initiation of new sprouts significantly increased fruit yield and quality. Digrase *et al.* (2016) [7] concluded that interactive treatment combination consisting of GA_3 75 ppm+ boron 0.3 per cent produced higher growth and yield of pomegranate cv. Bhagwa.

Supe and Marbhal (2008) [25] found that application of 6-BA at concentration of 10 ppm produced maximum fruit drop in pomegranate cv. Mridula. However, Sharma and Belsare (2011) [19] reported that foliar spray of CPPU at 5 ppm, when applied in mid-May increased fruit size and fruit weight in pomegranate cv. G-137. Roussos *et al.* (2009) [15] treated strawberry cv. Camarosa with different plant growth stimulators and reported that application of GA_3 + Auxin (Phenothiol) significantly increased marketable yield. Ghosh *et al*. (2009) [8] also recorded beneficial effects of NAA and GA3 in cv. Rubi, Adi and Prasad (2012) [1] in cv. Ganesh and Goswami *et al.* (2013) [9] in cv. Sindhuri of pomegranate.

5. Effect of plant growth regulators on fruit quality

Manivannan *et al.* (2015) [11] observed increase in ascorbic acid by applying 50 ppm NAA in guava (*Psidium guajava* L.) cv. L-49. Anawal *et al.* (2016) [2] found NAA (40 ppm) application more effective in increasing number of fruits per tree, fruit length, fruit weight, fruit volume, total soluble solids, total sugars, reducing sugars, non-reducing sugars as compared to control. Sheikh (2015) [20] noticed the highest reducing sugars (10.3%) in NAA 1500 ppm as against 7.15 per cent in control. Debnath *et al.* (2011) [5] recorded maximum reducing sugars, TSS to acid ratio, pulp weight, pulp to stone ratio and minimum titratable acid and stone weight when applied GA_3 100 ppm in phalsa. Mukunda *et al.* (2014) [13] indicated that the foliar spray of GA_3 at 50 ppm in June was found superior with respect to fruit weight, juice content and TSS in Acid Lime (*Citrus aurantifolia* Swingle) cv. Balaji.

Debnath *et al.* (2011) [5] recorded maximum shelf life of phalsa fruits by the application of kinetin 30 ppm. However, highest fruit firmness, maximum TSS, Brix- acid ratio and ascorbic acid content was observed in fruits treated with benzyl adenine 100 ppm in guava (*Psidium guajava* L.) cv. Allahabad safeda. Adi and Prasad (2012) [1] recorded the highest aril weight, aril percent after the application of 2,4-D 40 ppm followed by GA_3 75 ppm, however, NAA also significantly improved the aril weight, aril ratio and number of arils over control, but less effective than 2,4-D and GA_3. Similarly, application of 40 ppm NAA and 80 ppm GA_3 significantly increased fruit length and fruit diameter in pomegranate (Khalil and Aly, 2013) [10].

6. Conclusion

The exogenous application of bio-regulators might, therefore, act as a powerful tool not only for enhancing the growth, productivity, quality of fruits but also in combating the ill effects generated by various biotic and abiotic stresses in plants in the near future.

7. References

1. Adi PR, Prasad DM. Effect of plant growth regulators on fruit characters and yield of pomegranate (*Punica granatum* L.) cv. Ganesh. Int. J of Plant Animal and Environmental Scie. 2012; 2:91-93.
2. Anawal VV, Narayanaswamy P, Ekabote SD. Effects of plant regulators on fruit-set and yield of pomegranate cv. Bhagwa. Int. J of Current Res. 2016; 8:2908-2910.
3. Anawal VV, Narayanaswamy P, Kumar YHS. Effects of plant regulators on induction of flowering in pomegranate (*Punica granatum* L.) cv. Bhagwa. Int. J of Sci. Res. 2015; 4:7-9.
4. Bhat A, Kher R, Gupta SP. Effect of growth regulators and nutrients on fruit cracking and fruit quality in lemon. Haryana J of Hort. Scie. 2006; 35:267.
5. Debnath A, Vanajalatha K, Momin U, Reddy M. Effect of NAA, GA3, kinetin and ethrel on yield and quality in phalsa (Grewia sub-inaequalis DC). The Asian J of Hort. 2011; 6:474-477.
6. Devnath S, Kundu S. Effect of bioregulators and nutrients on growth and differentiation of mango (*Mangifera indica* L.) shoots. Environment and Ecology. 2001; 19:829-832.
7. Digrase SS, Tambe TB, Kadam AS, Kalalbandi BM. Effect of different plant growth regulators and chemicals on growth and yield of pomegranate (*Punica granatum* L.) cv. Bhagwa. Advance Research Journal of Crop Improvement. 2016; 7:96-99.
8. Ghosh SN, Bera B, Ray S, Kundu A. Effect of plant growth regulators in yield and quality in pomegranate cv. Rubi. Journal of Horticultural Sciences. 2009; 4:158-160.
9. Goswami JD, Patel NM, Bhadauria HS, Wankhade VR. Effect of plant growth substances on growth, fruit setting and yield of pomegranate cv. Sindhuri. International Journal of Agricultural Sciences. 2013; 1:332-334.
10. Khalil A, Aly SH. Cracking and fruit quality of pomegranate (*Punica granatum* L.) as affected by pre-harvest sprays of some growth regulators and mineral nutrients. Journal of Horticultural Science & Ornamental Plants. 2013; 5:71-76.
11. Manivannan MI, Irulandi S, Thingalmaniyan KS. Studies on the effect of preharvest application of plant growth regulators and chemicals on yield and quality of guava (*Psidium guajava* L.) cv. L.-49. International Journal of Agricultural Sciences. 2015; 11:138-140.
12. Momenpour A, Taghavi TS, Manocher S. Effect of benzyl adenin and gibberellin on runner production and some

vegetative traits of three strawberry cultivars. African Journal of Agricultural Research. 2009; 6:4357-4361.
13. Mukunda LL, Ramana KTV, Krishna VNP, Yuvaraj KM, Lakshmi TN, Sarada G *et al*. Effect of growth regulators and chemicals on fruit yield and quality of hasta bahar flowering in acid lime (*Citrus aurantifolia* Swingle) cv. Balaji. Journal of Agriculture and Allied Sciences. 2014; 3:11-13.
14. Perez DCM, Mogollon N, Ojeda M, Gimenez A, Colmenares C. The effect of GA3 on the growth and flowering of strawberry cv. Chandler vitroplants. Acta Horticulture. 2009; 842:793-796.
15. Roussos PA, Denaxa NK, Damvakaris T. Strawberry fruit quality attributes after application of plant growth stimulating compounds. Scientia Horticulture. 2009; 119:138-146.
16. Saied E, Mohammad RS, Babak J, Mohammad S. Influence of foliar application of Volk oil, Dormex, GA_3 and Potassium Nitrate on vegetative growth and reproductive characteristic of strawberry cv. Merak. Journals of Environmental Biology. 2012; 6:35-38.
17. Sharma G, Ananda SA. Effect of pre-bloom foliar application of plant bioregulators on growth, fruiting and quality of apple under warmer agroclimatic conditions. Acta Horticulture. 2004; 662:353-357.
18. Sharma G. Effect of environmental conditions, nutrient, plant growth regulator applications and orchard floor management practices on flowering, fruit set, yield and quality in apple. PhD. Thesis. Dr YS Parmar University of Horticulture and Forestry, Nauni, Solan, HP, India, 2004.
19. Sharma N, Belsare C. Effect of plant bio-regulators and nutrients on fruit cracking and quality in pomegranate (*Punica granatum* L.) 'G-137' in Himachal Pradesh. Acta Horticulture. 2011; 890:347-352.
20. Sheikh MK. Effect of growth regulators and hand thinning of flowers/fruits on size of pomegranate (*Punica granatum* L.) 'Ganesh'. Acta Horticulture. 2015; 1089:407-410.
21. Singh A, Singh JN. Flowering, fruiting and yield responses to plant bioregulators of strawberry cv. Sweet Charlie. Environment and Ecology. 2005; 23:714-716.
22. Singh G. Effect of irrigation, foliar fertilization and plant bioregulators on growth, yield and quality of pomegranate cv. G-137. PhD. Thesis. Dr YS Parmar University of Horticulture and Forestry, Nauni, Solan, HP, India, 2008.
23. Singh K. Effect of plant growth regulators on vegetative growth, flowering, fruit set and fruit quality of Baggughosha pear. MSc. Thesis. Dr YS Parmar University of Horticulture and Forestry, Nauni, Solan, HP, India, 2004.
24. Suman M, Sangma PD, Meghawal DR, Sahu OP. effect of plant growth regulators on fruit crops. Journal of Pharmacognosy and Phytochemistry. 2017; 6:331-337.
25. Supe VS, Marbhal SK. Effect of plant growth substances on fruit size of pomegranate (*Punica granatum* L.) cv. Mridula. The Asian Journal of Horticulture. 2008; 3:18-20.
26. Vejendla V, Maity PK, Bank BC. Effect of chemicals and growth regulators on fruit retention, yield and quality of mango cv. Amrapali. Journal of Crop and Weed. 2008; 4:45-46.