International Journal of Advanced Biochemistry Research

ISSN Print: 2617-4693
ISSN Online: 2617-4707
NAAS Rating (2025): 5.29
IJABR 2025; SP-9(10): 1049-1052
www.biochemjournal.com
Received: 09-08-2025
Accepted: 11-09-2025

A Pavithra
PG Scholar, Department of Fruit Science, College of Horticulture, Mudigere, Karnataka, India

Sridhar R
Associate Professor, Department of Fruit Science, College of Horticulture, Mudigere, Karnataka, India

Ganapathi M
Associate Professor, Department of Crop Physiology, College of Agriculture, Navile, Shivamogga, Karnataka, India

Kiran Kumar R
Assistant Professor of Horticulture, ZAHRS, Mudigere, Karnataka, India

Nandini C
Assistant Professor, Genetics and Plant breeding, ZAHRS, Babbur farm, Hiriyur, Karnataka, India

Corresponding Author:
A Pavithra
PG Scholar, Department of Fruit Science, College of Horticulture, Mudigere, Karnataka, India

Influence of plant growth substances on fruit quality of pomegranate cv. Bhagwa

A Pavithra, Sridhar R, Ganapathi M, Kiran Kumar R and Nandini C

DOI: https://www.doi.org/10.33545/26174693.2025.v9.i10Sm.5987

Abstract
The experiment was carried out in farmers field, Hiriyur, (Chitradurga district) during the year 2024-2025 on "Influence of plant growth substances on fruit quality in pomegranate (*Punica granatum* L.) cv. Bhagwa". The experiment was laid out in Randomized Block Design comprising eleven treatments *viz.*, T_1-Control (water spray), T_2-Napthalene acetic acid (NAA) @ 20 ppm, T_3-Napthalene acetic acid (NAA) @ 40 ppm, T_4-6-Benzyl adenine @ 20 ppm, T_5-6-Benzyl adenine @ 40 ppm, T_6-Cycocel @ 1500 ppm, T_7-Cycocel @ 2000 ppm, T_8-Amino acids @ 1000 ppm, T_9-Amino acids @ 2000 ppm, T_{10}-Seaweed extract @ 2000 ppm and T_{11}-Seaweed extract @ 4000 ppm with three replications, sprayed at an interval of 75 and 120 days after first irrigation. Among the treatments, T_{11}-Seaweed extract @ 4000 ppm recorded highest total soluble solids (17.97 ºBrix), total sugar (14.72 %) and TSS-Acid ratio (46.38). T_7-Cycocel @ 2000 ppm recorded maximum anthocyanin (23.23 mg/100 g) and minimum acidity (0.39 %). As a result of the research, Cycocel @ 2000 ppm and Seaweed extract @ 4000 ppm proved to be enhancing fruit quality in pomegranate.

Keywords: Pomegranate, Bhagwa, fruit quality, plant growth substances

Introduction
Pomegranate (*Punica granatum* L.) belonging to the Lythraceae family, it is commercially important fruit crop grown in arid and semi-arid areas of India and is valued for its refreshing taste and numerous health benefits. It has immense medicinal and nutritional value, it is one of the richest sources of antioxidants (Fischer *et al.*, 2011) [9]. The fruits are mainly used for dessert purposes and are processed to make juices, syrup, jelly and anardana. In addition, pomegranate is abundant in bioflavonoids and organic acids such as ascorbic acid, ellagic acid, gallic acid, caffeine acid, catechin, minerals, amino acids, quercetin and rutin. The pomegranate area is increasing rapidly owing to its steady demand, good keeping quality, high nutritional and medicinal value, heat and drought tolerance and wider adaptability to different soils and climatic conditions (Chandra *et al.*, 2010) [4]. Among the many pomegranate cultivars, "Bhagwa" has gained importance. The variety is suitable for light to medium soil and dry weather with low humidity. The fruits are larger (305-420 g). The fruit surface is glossy and has an attractive deep red colour in both the rind and arils, rind thickness and soft seeds. Bhagwa is the most widely grown cultivar of pomegranate in Maharashtra. In addition, Bhagwa is in high demand for export to foreign markets (Dhinesh *et al.*, 2011) [9].

Plant growth regulators (PGRs) and bio-stimulants have emerged as promising tools for enhancing fruit set, yield and quality in various crops. PGRs, such as gibberellins, cytokinins, auxins and growth retardants at various concentrations play vital roles in regulation of various physiological processes (Bhujbal *et al.*, 2013) [3]. Biostimulants include substances such as seaweed extract, amino acids and chitosan, which enhance plant growth and stress tolerance. These products improve nutrient uptake, boost plant metabolism and strengthen the ability to cope with biotic and abiotic stresses, ultimately leading to improved flowering, fruit set and fruit quality (Abobatta, 2020) [1].

By understanding effectiveness of these plant growth substances, the research was laid out to explore various plant growth regulators and bio-stimulants on improve the fruit quality of pomegranate.

Materials and Methods

The study was conducted in the farmer's field Hiriyur, Chitradurga district. The experimental site was located in the Central Dry Zone (Zone IV) of Karnataka. The experiment was laid out in Randomized Block Design comprising eleven treatments *viz.*, T_1-Control (water spray), T_2-NAA (20 ppm), T_3-NAA (40 ppm), T_4-6-Benzyl adenine (20 ppm), T_5-6-Benzyl adenine (40 ppm), T_6-Cycocel (1500 ppm), T_7-Cycocel (2000 ppm), T_8-Amino acids (1000 ppm), T_9-Amino acids (2000 ppm), T_{10}-Seaweed extract (2000 ppm) and T_{11}-Seaweed extract (4000 ppm) with three replications, sprayed at an interval of 75 and 120 days after the first irrigation. During the cropping period February 2025 to August 2025, the mean maximum and minimum temperatures were 32.44 °C and 20.31 °C, respectively and mean relative humidity during morning and evening hours were 81.71 and 52.23 percent respectively with the total rainfall of 413.2 mm. All the plants were initially stressed by withholding irrigation for a month and defoliation was achieved by foliar application of ethrel @ 2 ml litre (prior to imposition of treatments) followed by light pruning. The spacing adopted was 5.0 × 5.0 m. Before and during the study, standard cultural procedures were carried out.

Fruits were harvested in the month of second week of August, when most of the fruits in the tree were ready for the harvest by considering the maturity indices like colour change from yellowish to dark red, glossy appearance and cracking sound on pressing the fruits. Fruits were harvested at morning hours. Five fruits from each treatment with the true representation of the individual treatment were selected and used further to determine the fruit quality parameters like total soluble solids of the juice were determined using a digital refractometer, the titratable acidity of the juice extract was determined according to A.O.A.C (1980) [2], The total sugars present in the pomegranate fruit samples were estimated using the anthrone reagent method (Ranganna, 1978) [23] and the total anthocyanin content was quantitatively determined according to the method described by Lee *et al.*, 2005 [16]. The data were statistically analysed using the analysis of variance by Fisher and Yates (1963) [10] and Duncan's multiple range test was employed to differentiate means at 5 percent by using OPSTAT software.

Results and Discussion

Total soluble solids (ºBrix)

The data pertaining on impact of plant growth substances on total soluble solids (TSS) is detailed in table 1. There was a significant variation among the treatments for TSS. The maximum TSS was found in T_{11}-Seaweed extract @ 4000 ppm (17.97 ºBrix) resulting in 11.75 percent increase compared to control (16.08 ºBrix) and T_{11}-Seaweed extract @ 4000 ppm was on par with T_7-Cycocel @ 2000 ppm (17.57 ºBrix).

Seaweed extract is made up of a variety of micronutrients that have a role in the creation of proteins, amino acids, carbohydrates and other compounds. When seaweed extract was administered as a foliar treatment, the micronutrients were absorbed by the leaves, possibly leading to an increase in photo-assimilate production. Increased total soluble solids content came from photo-assimilates transported to the sink (fruit) via the phloem. Micronutrients, on the other hand, have a catalytic effect that improves macronutrient absorption in plant tissues, leading to improved fruit quality by boosting SSC content (Rana and Rana., 2003) [21].

Acidity (%)

The data recorded on titratable acidity revealed that, spraying of plant growth substances led to significant difference among the treatments which is illustrated in table 1. The maximum acidity (0.64 %) was found in T_1-control and the minimum acidity (0.39 %) was found in T_7-Cycocel @ 2000 ppm, which was on par with T_{11}-Seaweed extract @ 4000 ppm (0.40 %).

Reduced acidity under cycocel treatment may be due to enhanced carbohydrate metabolism and higher conversion of organic acids into sugars during ripening reported in grapes (Kaur *et al.*, 2023) [14], kagzi lime (Choudary *et al.*, 2024) [5] and pomegranate (Hussain *et al.*, 2021) [13].

TSS-Acid ratio

The TSS-Acid ratio showed considerable variation, as illustrated in table 1. The maximum TSS-Acid ratio (46.38) was found in T_{11}-Seaweed extract @ 4000 ppm on par with T_7-Cycocel @ 2000 ppm (46.36). Conversely, the minimum TSS-Acid ratio (25.33) was recorded in T_1-Control.

The increase in TSS-Acid ratio under seaweed extract treatment is due to the combined effect of increased soluble solids and reduced acidity. Higher accumulation of sugars and lower organic acid concentration improve sweetness and flavour balance of fruits. The catalytic effect of micronutrients in seaweed also enhances assimilation and sugar transport into fruits, thereby improving the TSS: acid ratio. Similar findings were reported in grapes (Rana and Rana, 2003) [21] and Dash *et al.* (2020) [6] in mango.

Total sugar (%)

The statistically analysed data on total sugars is represented in table 1. The total sugars differed significantly among the treatments. The maximum total sugars (14.72 %) was observed in T_{11}-Seaweed extract @ 4000 ppm followed by T_7-Cycocel @ 2000 ppm (14.53 %). The minimum total sugars (12.91 %) was recorded in T_1-Control.

Application of seaweed extract may be attributed to improved assimilates towards reproductive growth and the quick metabolic transformation of starch and pectin into soluble compounds and rapid conversion of sugars from the leaves to developing fruits. Similar results were observed in Dash *et al.* (2020) [6] in mango, Rana *et al.* (2023) [22] in kiwifruit and Patel *et al.* (2021) [18] in papaya.

Anthocyanin (mg/100 g)

The total anthocyanin content showed considerable variation, as illustrated in table 1. The maximum total anthocyanin content (23.23 mg/100 g) was found in T_7-Cycocel @ 2000 ppm. Conversely, the minimum total anthocyanin content (18.06 mg/100 g) was recorded in T_1-Control.

Cycocel enhances anthocyanin accumulation by promoting phenolic biosynthesis and delaying oxidative degradation. Higher anthocyanin levels improve fruit coloration and antioxidant properties, making the fruits more appealing to consumers. Similar findings were reported in (Kaur *et al.*, 2023) [14], pomegranate (Hussain *et al.*, 2021) [13] and papaya (Hazarika *et al.*, 2016) [12].

Table 1: Effect of plant growth substances on biochemical parameters of pomegranate cv. Bhagwa

Treatments details	Total soluble solids (^{O}Brix)	Acidity (%)	TSS-Acid ratio	Total sugar (%)	Anthocyanin (mg/100 g)
T_1 : Control	16.08^{c}	0.64^{a}	25.33^{d}	12.91^{h}	18.06^{b}
T_2 : NAA @ 20 ppm	16.10^{c}	0.52^{bc}	31.74^{cd}	13.25^{g}	20.18^{ab}
T_3 : NAA @ 40 ppm	16.08^{c}	0.53^{b}	30.35^{cd}	12.92^{h}	19.84^{ab}
T_4: 6-Benzyl adenine @ 20 ppm	17.03^{bc}	0.44^{bcd}	38.48^{bc}	13.53^{c}	22.98^{a}
T_5 : 6-Benzyl adenine @ 40 ppm	16.14^{c}	0.51^{bcd}	31.65^{cd}	13.36^{f}	20.38^{ab}
T_6 : Cycocel @ 1500 ppm	16.48^{c}	0.48^{bcd}	34.38^{c}	13.44^{de}	21.61^{ab}
T_7 : Cycocel @ 2000 ppm	17.57^{ab}	0.39^{d}	46.36^{ab}	14.53^{b}	23.23^{a}
T_8 : Amino acids @ 1000 ppm	16.18^{c}	0.50^{bcd}	32.62^{cd}	13.43^{e}	21.45^{ab}
T_9 : Amino acids @ 2000 ppm	16.72^{bc}	0.45^{bcd}	37.95^{c}	13.51^{c}	22.24^{ab}
T_{10}: Seaweed extract @ 2000 ppm	16.56^{c}	0.47^{bcd}	35.29^{c}	13.47^{d}	21.87^{ab}
T_{11}: Seaweed extract @ 4000 ppm	17.97^{a}	0.40^{cd}	46.38^{a}	14.72^{a}	23.07^{a}
S.Em ±	0.30	0.04	2.59	0.01	1.34
C.D. @ 5%	0.88	0.11	7.63	0.04	3.94

Means within a column followed by different letters are significantly different at $p \leq 0.05$ by Duncan's multiple range test

Conclusion

Foliar spray of cycocel @ 2000 ppm registered maximum anthocyanin and minimum acidity. On the other hand, Seaweed extract @ 4000 ppm exhibited its superiority in enhancing TSS, total sugar and TSS-Acid ratio on par with cycocel. Therefore, both cycocel and seaweed extract were effective plant growth substances for achieving better fruit quality in pomegranate cv. Bhagwa.

Acknowledgement

Authors are heartly thankful to the Director of Research, University of Agricultural and Horticultural Sciences, Shivamogga for providing necessary facilities.

References

1. Abobatta WF. Plant stimulants and horticultural production. Eco Environ Sci. 2020;5(6):261-265.
2. AOAC. Official Methods of Analytical Chemists. Association of Official Chemists, Washington, USA; 1980. p. 617-623.
3. Bhujbal DS, Naik DM, Kale SA. Studies on effect of growth regulators on flowering, fruiting and quality of sapota. Int J Ag Sci. 2013;9(1):289-292.
4. Chandra R, Jadhav VT, Sharma J. Global scenario of pomegranate (*Punica granatum* L.) culture with special reference to India. Fruits Veg Cereals Sci Biotechnol. 2010;4:7-18.
5. Choudhary S, Kumar R, Bakshi P, Sinha BK, Raina NS, Sharma R, Jadhav M. Effect of cycocel and micronutrients on quality parameters of Kagzi lime (*Citrus aurantifolia* Swingle). Int J Adv Biochem Res. 2024;8(8):741-744.
6. Dash A, Samant D, Dash DK, Dash SN, Mishra KN. Influence of *Ascophyllum nodosum* extract, homobrassinolide and triacontanol on fruit retention, yield and quality of mango. J Environ Biol. 2020;42:1085-1091.
7. Debbarma N, Hazarika BN. Effect of plant growth regulators and chemicals on yield and quality of acid lime (*Citrus aurantifolia* Swingle) under foothill condition of Arunachal Pradesh. Int J Agri Environ Biotechnol. 2016;9(2):231.
8. Durgude RA, Supe VS, Kulkarni SS, Chavan UD, Nimbalkar CA. Effect of different chemicals on flowering, fruit set and yield in pomegranate (*Punica granatum* L.) cv. Phule Bhagwa. Int J Chem Stud. 2019;7(3):1836-1841.
9. Fischer UA, Carle R, Kammerer DR. Identification and quantification of phenolic compounds from pomegranate (*Punica granatum* L.) peel, mesocarp, aril and differently produced juices by HPLC-DAD-ESI/MS^{n}. Food Chem. 2011;127:807-821.
10. Fisher RA, Yates F. Statistical Tables. Oliver and Boyd, Edinburgh, Tweed Date Court, London; 1963.
11. Gupta S, Kashyap DMS. Effective administration of plant growth regulators in horticultural crops: A review. Int J Plant Soil Sci. 2023;35(11):36-46.
12. Hazarika TK, Balsri DS, Mandal D, Nautiyal BP, Shukla AC. Effect of plant growth regulators on growth, yield and quality of tissue cultured papaya (*Carica papaya* L.) cv. Red Lady. Indian J Hortic Sci. 2016;86(3):404-408.
13. Hussain F, Murthy BNS, Reddy MLN, Satisha J, Upreti KK, Laxman RH, *et al.* Induction of flowering and improvement of fruit yield and quality in pomegranate (*Punica granatum* L.) cv. Bhagwa by various plant growth regulators. Environ Conserv J. 2021;22(1&2):49-58.
14. Kaur J, Kaur G, Kaur K, Arora NK. Effect of chlormequat chloride application on vegetative growth and overall quality of grape cultivars under protected cultivation. Erwerbs-Obstbau. 2023;65(6):1921-1929.
15. Kumar R, Sharma N, Jamwal M, Sharma RM, Singh DB, Parmar AM. Production and economic studies of PGRs treated strawberry (*Fragaria* × *ananassa* Duch.) cv. Sweet Charlie. Am Eurasian J Agri Environ Sci. 2012;12:1543-1547.
16. Lee J, Durst RW, Wrolstad RE. Determination of total monomeric anthocyanin pigment concentration of fruit juices, beverages, natural colorants, and wines by the pH differential method: Collaborative study. J AOAC Int. 2005;88(5):1269-1278.
17. Narayan L, Das RP, Lekh RV. Effect of plant growth regulators on flowering and fruit growth of guava (*Psidium guajava* L.) cv. Allahabad Safeda. Asian J Hortic. 2013;8:54-56.
18. Patel D, Ahlawat TR, Pandey AK, Jena S. Improved fruit quality in papaya cv. Red Lady through foliar sprays of silicon and seaweed extract. J Pharma Innov. 2021;10(5):1514-1516.
19. Patil SR, Ganvir MM, Nagdeve MB, Patode RS. Effect of growth regulators on flower regulation in mango var. Pairi. Proc 3rd Natl Conf Water Environ Soc. 2016;2-76.

20. Rai O, Patil SN, Patil DR, Shalu V, Awati M, Kiran KC. Effect of plant growth regulators and chemical on vegetative and reproductive parameters during Hasta Bahar in acid lime (*Citrus aurantifolia* Swingle). Int J Curr Microbiol Appl Sci. 2018;7(9):2640-2650.
21. Rana VS, Rana NS. Studies on fruit growth and organic metabolites in developing kiwifruit. Indian J Plant Physiol. 2003;8:138-140.
22. Rana VS, Sharma V, Sharma S, Rana N, Kumar V, Sharma U, *et al.* Seaweed extract as a biostimulant agent to enhance the fruit growth, yield, and quality of kiwifruit. Horticulturae. 2023;9(4):14-23.
23. Ranganna S. Manual of Analysis of Fruits and Vegetables Products. Tata McGraw-Hill Publishing Co. Ltd., New Delhi; 1978. p. 255.
24. Subrata M, Subham G, Ghosh SN. Effect of CCC, KNO_3, $ZnSO_4$ and MAP on flowering and yield of wood apple (*Feronia limonia* Swingle). Int J Chem Stud. 2019;7(2):2069-2071.