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Effect of different chemical spray on quality of pomegranate CV. Bhagwa

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Abstract
The field study was carried out on the field of Horticulture (pomology) VNMKV, Parbhani. The experiment was laid out in Randomized Block Design (RBD) with Ten treatments viz., T_1 NAA (40 ppm) + Boron (0.3%), T_2 NAA (40 ppm) + $CaCl_2$ (1.5%), T_3 NAA (40 ppm) + $ZnSO_4$ (0.2%), T_4 GA_3 (75 ppm) + Boron (0.3%), T_5 GA3 (75 ppm) + CaCl2(1.5%), T_6 GA_3 (75 ppm) + $ZnSO_4$ (0.2%), T_7 2,4-D (20 ppm) + Boron (0.3%), T_8 2,4-D (20 ppm) + $CaCl_2$ (1.5%),T_9 2,4-D (20 ppm) + $ZnSO_4$ (0.2%), T_{10} control with three replications. The observation on quality of pomegranate fruits were superior in treatment T_4 i.e. spraying of GA_3 (75 ppm) + Boron (0.3%) more as compared to control. Close analysis of the present investigation revealed that the foliar application of alone or in combination with plant growth regulators and chemicals were able to improve the quality characters viz, Sugars, total soluble solid, juice percentage and anthocynine of pomegranate cv. Bhagwa it helps to improve the quality and acceptability of pomegranate.

Keywords: pomegranate, yield, foliar, chemicals, plant growth regulator

Introduction
Pomegranate (Punica granatum L.), commonly known by the name "Anar", belongs to the plant family Punicaceae. It is an ancient tree native to the Middle East, probably Iran. It is reported to have been cultivated some 5000 to 6000 or more years ago. It is economically important plant and had been used by mankind since the dawn of civilization. There are many myths, legends and folklore associated with this unique, delicious and fascinating fruit as it has seeds. It is documented in Greek mythology, Egyptian papyrus, Biblisold Testament, Roman history, Koran and Indian Sanskrit scriptures. Pomegranate is one of the favourite table fruit of tropical and subtropical regions. It is now extensively cultivated in the Mediterranean countries (Spain, Morocco, Turkey, Tunisia), Egypt, Iran, Afghanistan, Balochistan (Pakistan) and India.
In India major pomegranate producing states are Maharashtra, Karnataka, Gujrat, Andhra Pradesh, Madhya Pradesh, Tamil Nadu and Rajasthan. Maharashtra is in the leading state with 136.75 thousand ha area with annual production of 1578 Mt and productivity of 11.54 Mt/ha. Maharashtra state accounts for 78 per cent of the total area in India and 84 per cent of the total production in the country. The prominent pockets where pomegranate cultivated area are concentrated are Solapur, Nashik, Sangli, Satara and ahemednagar districts of Western region of Maharashtra.

Material and method
Pomegranate garden located at Horticulture Research Sche me (Pomology), Vasantrao Naik Marathwada Krishi Vidyapeeth Parbhani during the year 2017-18. The pomegranate plants planted at 6.0 X 3.0 m spacing replicated thricely two plant were taken for each treatment and five fruit per plants were selected to study the physical and chemical composition of pomegranate cv. Bhagwa.
The experimental site falls under Parbhani conditions and categorized as semi arid tropics. However, various seasons have caused it to categorize as sub-humid to humid in monsoon semi and winter and arid in summer. The average annual precipitation (worked out on the basic of last 30 years) of the district is 844 mm and the region has been categorized as an assured rainfall agro-climatic zone.
The Parbhani area is dominated by black soils which are formed from basaltic material originating through volcanic eruptions.
The soil is characterized by black colour dominated by montmorillonite clay with high coefficient of expansion when wet and shrinkage in summer leading to deep cracking, the soils are alkaline in reaction with high base saturation.

Time of application of chemicals

Sr. No.	Chemicals	Time of application Days after flowering (DAF)		
1	NAA	45	90	-
2	GA_3	45	90	-
3	2-4-D	45	90	-
4	Boron	90	105	135
5	$CaCl_2$	90	105	135
6	$ZnSo_4$	90	105	135

The plant growth regulators were applied by foliar spray with the fine sprayer. Care was also taken to avoid spray of one solution over other treatments. The spray was washed with the clean water after the application of every solution of plant growth regulator.

Result and discussion

A. Quality attributes

Total soluble solid (ºBrix)

The data regarding quality attributes given in table 1. The highest TSS (17.05^{0}B) was recorded in treatment) T_4 i.e. spraying of GA_3 (75 ppm) + Boron (0.5%) which was 7.56 per cent more than control treatment. It was at par with treatment T_6, T_1, T_5 and the lowest TSS was recorded in treatment T_1 i.e. control (15.88^{0}B).

The primitive effect of gibberellins to increase the TSS might be due to the influence of gibberellins in activation of the amylase enzyme which is responsible for the conservation of starch into sugars have influenced the physiological process, particularly respiration and photosynthesis, which ultimately leads to accumulation of more dry matter, minerals and carbohydrates in the fruit and this may due to increase in activity of amylase. It seems that GA_3 probably affects fruit quality depending on timing, concentration and environmental condition after fruit set (Sharma and Belsare 2009) [9]. The beneficial effects of plant growth regulators in improving TSS content in pomegranate was also observed by Lal and Ahmed (2012) [5], Reddy (2010) [8], Mohamad, (2003) [7] and Pawar (2005) [6]. Bhise (2014) [2] in acid lime, Jagtap *et al.* (2013) [6] in Sweet Lime and Shukla *et al.* (2011) [10] in Aonla.

Improvement in TSS of fruit due to GA_3 and boron spray might be explained from the fact that application of GA_3 and boron probably improved the physiology of leaves, thereby causing better translocation of vital components in the fruit and assimilation as well as utilization of photosynthates by developing fruits. The results obtained in the present study are in agreement with that reported by Shukla *et al.* (2011) [10] in Aonla.

Titrable acidity (%)

The minimum acidity (0.21%) was recorded in treatment T_4 i.e. spraying of GA_3 (75 ppm) + Boron (0.5%). However, it was at par with T_6 i.e. spraying of GA_3 (75 ppm) + $ZnSO_4$ (0.2%) (0.26%).The maximum acidity were found in T_1 i.e. control.

The reduction in acidity might be due to rapid utilization of organic acids during respiration or by the conversion of organic acids into sugars or salts by enzyme or both. These findings are in close conformity with reports of Rao and Chundawat (1984). B and Fe plays an important role in carbon assimilation and in synthesis. Certain organic compound and application of Fe and B to banana significantly reduce the acidity and increase quality. Similar type of study done by Kumar *et al.* (2011) in guava and significantly recorded the highest acidity (0.74%) with the application of B (0.25%).

B. Biochemical attributes

Reducing, Non reducing, Total sugar (%)

Regarding sweetness of pomegranate is due to sugars percentage in fruit. However the all sugars content viz., reducing, non reducing and total sugars were recorded maximum in treatment T_4 , which was commonly at par with treatment T_1, T_5 , T_9 , T_6 and T_7 and the lowest sugars were recorded in treatment T_{10} i.e. control.

Effect of micronutrients and growth regulators showed significant differences in respect of reducing sugars. The sugar content in juice of pomegranate fruit was recorded maximum with the treatment of boron this might be due to boron played major role in cell wall membrane function, cell wall strength and development, cell division, fruit and seed development and sugar transport (Soni *et al*. 2000).this might be due to hydrolysis of complex polysaccharides into simple sugars, synthesis of metabolites and rapid translocation of photosynthetic products and minerals from other parts of plant to developing fruits. These results are agreement with findings of Lal and Ahmed (2014) [5] in pomegranate .

Similar type of study was done by Digrase (2015) in pomegranate. Highest total sugar contents probably due to reduced rate of catabolic activities like respiration under the influence of plant growth regulators as opined by Vijaykumar and Shanmugavelu (1985) [12] in banana.

C. Juice (%) and Anthocynine content (mg/100gm)

Juice (%)

The maximum percentage of juice were recorded in treatment T_4 i.e. spraying of GA_3 (75 ppm) + Boron (0.5%) (71.58%), this was 45.91 per cent more as compared to control. However, it was at par with treatment T_6, T_1 , and T_5. The minimum juice (49.60%) was observed in treatment T_{10} i.e. control.

Anthocynine (mg/100gm)

Treatment T_4 i.e. spraying of GA_3 (75 ppm) + Boron (0.5%) recorded maximum anthocyanin (16.08 mg/100gm), which was 6.49 per cent more as compared to control treatment, which was at par with treatment at par with treatment T_6, T_1 , and T_5. The lowest anthocyanin was recorded in treatment T_{10} i.e. control (15.10 mg/100gm).

The increase in juice percentage might be attributed to increased water uptake by the GA_3 applied fruits which enhanced rate of cell enlargement increased the juice content in the fruits. The increase in the juice appears to be due to translocation of sugars and water in the arils. Similar results reported by Lal and Ahmed (2012) [9] in pomegranate.

Table 1: Effect of plant growth regulators and micronutrients on quality attributes of pomegranate Cv. Bhagwa.

Tr. No.	TSS (ºBrix)	Acidity (%)	Reducing Sugar (%)	Non reducing sugar (%)	Total Sugar (%)	Juice (%)	Anthocynine (mg/100gm)
T_1	16.23 (2.20)	0.31 (-16.21)	14.15 (4.12)	0.71 (-7.79)	14.86 (3.48)	66.98 (35.04)	15.84 (4.90)
T_2	15.83 (-0.31)	0.28 (-24.32)	12.85 (-5.44)	0.90 (16.88)	13.85 (-3.55)	60.27 (21.39)	15.64 (3.57)
T_3	16.15 (1.70)	0.31 (-16.21)	14.05 (3.38)	0.20 (-74.02)	14.33 (-0.20)	66.18 (33.42)	15.80 (4.63)
T_4	17.05 (7.36)	0.21 (-43.24)	14.60 (7.43)	0.88 (14.28)	14.99 (4.38)	71.38 (43.91)	16.08 (6.49)
T_5	16.08	0.30	13.29	0.80	14.18	64.16	15.73

	(1.25)	(-18.91)	(-2.20)	(3.89)	(-1.25)	(29.35)	(4.17)
T_6	16.23 (2.20)	0.26 (-29.72)	13.94 (2.57)	0.61 (-20.77)	14.59 (1.60)	68.92 (38.95)	15.86 (5.03)
T_7	16.28 (2.51)	0.27 (-27.02)	13.89 (2.20)	0.97 (25.97)	14.86 (3.48)	59.77 (20.50)	15.52 (2.78)
T_8	15.95 (0.44)	0.31 (-16.21)	12.94 (-4.78)	0.90 (16.88)	13.88 (-3.34)	54.37 (9.61)	15.12 (0.13)
T_9	15.93 (0.31)	0.31 (-16.21)	14.04 (3.31)	0.69 (-10.38)	14.76 (2.78)	57.13 (15.18)	15.14 (0.26)
T_{10}	15.88	0.37	13.59	0.77	14.36	49.60	15.10
S.E ±	1.06	0.019	0.91	0.047	0.95	4.15	1.02
C.D@ 5%	N.S	0.057	N.S	0.14	N.S	12.32	N.S

(Figures in parenthesis indicates the values of respective characters in percentage decreased as compared to control)

Conclusion

In summing up the present investigation based on obtained results, the combination of all plant growth regulators and micronutrients application positively influenced on quality attributes of pomegranate fruits as compared to control. The all treatment combination, among that GA3 @ 75 PPM and Boron 0.3% produced superior quality of pomegranate fruits. In nut shell it can be concluded that foliar application of GA@ 75 PPM and Boron 0.3% at 90, 105 and 135 days after flowering was beneficially improve the quality attributes of pomegranate fruit.

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