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RESEARCH ARTICLE

EFFECTS OF PLANT GROWTH REGULATORS ON FRUIT SET AND YIELD OF POMEGRANATE CV. BHAGWA

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ABSTRACT

An experiment was conducted during 2014-15 at Hiriyur, Chitradurga district to study the response of various plant growth regulators at different concentrations namely, NAA (40, 50, 60 ppm) and GA_3 (40, 50, 60 ppm) on fruit set and yield of pomegranate cv. Bhagwa. The results indicated that NAA 40 ppm was found effective in increasing number of fruits per tree (62.44), fruit length (8.66 cm), fruit diameter (8.71 cm), fruit weight (262.23 g), fruit volume (255.44 ml), TSS (16.76˚B), total sugars (15.58 %), reducing sugars (13.83 %), non-reducing sugars(1.75 %) against control.

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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). Though, it is native of Iran but cultivated extensively in Mediterranean and central Asian countries. It is highly suitable for growing under arid and semiarid regions due to its versatile adaptability, hardy nature, low cost maintenance and high returns. In recent past its wide significance in health, nutrition and livelihood security has been recognized which resulted in heavy demand for fruit consumption not only in India but throughout the globe. In India, pomegranate is commercially cultivated in Maharashtra, Karnataka and Andhra Pradesh and the most important cultivar in this pomegranate belt is 'Bhagwa' which covers around 80% area under pomegranate in Maharashtra. Since last two decades, its cultivation has popularized in arid and semi-arid regions of India, not only because of its sweet acidic taste, precocious bearing and better shelf-life but as a remunerative crop as well. Among various arid fruits, pomegranate occupies second largest area after ber. The importance of synthetic plant growth regulators in achieving higher yield and better quality of horticultural crop has been well recognized in recent time. Plant growth regulators have given encouraging results in case of pomegranate fruit crop. However, practically, there has been very little work done on use of plant growth regulators in pomegranate crop. Hence, the objective was to study the effects of plant growth regulators on the fruit set and yield of pomegranate cv. Bhagwa.

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MATERIALS AND METHODS

The experiment was conducted at farmers field Hosayalanadu, Hiriyur, Chitradurga district during 2014-15 on Bhagwa planted at a spacing of 12ft ×10ft.The experimental trees were four years old. Totally, 7 different treatments of NAA and GA_3 at different concentrations were sprayed in pomegranate orchard with three replications. The experiment was laid out in a Randomized Block Design. The growth regulators were sparyed after full bloom. Rest of the cultivation practices were as per the university package of practice. Three plants were sprayed in each treatment. The days taken for fruit set was calculated by taking the observation from the day of spraying to till fruit set. The yield was recorded at the time of harvest and expressed in terms of kg/plant. The physiological loss in weight was recorded by taking readings at 4 days intervals after harvest. The data recorded was analyzed using the stastistical procedures as described by Fisher and Yates (1963).

RESULTS AND DISCUSSION

The data pertaining to the number of days taken for fruit set as influenced by different growth regulators and their concentrations are furnished in Table 1. The number of days taken for fruit set in relation to different growth regulators was found to be non-significant. Among the different treatments, the plants treated with NAA 40 ppm showed minimum days (37.55) taken for fruit set followed by NAA 50 ppm (38.22) as against control (40.66). The data revealed that the different treatments had significant effect on yield parameters (Table 1). The maximum number of fruits per plant (62.44), yield in (16.45 kg/plant and 15232.70 kg/ha) was recorded with application of NAA 40 ppm. This may be due to the better physiology of developing fruits in terms of better supply of water, nutrients and other compounds vital for their proper growth and development which resulted in improved size and ultimately greater yield as compared to GA_3. Beneficial effects of NAA and GA_3 were recorded by Ghosh *et al*. (2009) in cv. Ruby, Adi and Prasad (2012) in cv. Ganesh and Goswami *et al*. (2013) in cv. Sindhuri of pomegranate. The data (Table 1) indicate that application of various chemicals significantly improved the physical parameters of the fruit. Maximum fruit length (8.66 cm), fruit diameter (8.71 cm), fruit weight (262.23 g) and fruit volume (255.44 ml) was recorded with foliar spray of 40 ppm NAA. This may be due to immediate absorption of auxins, which increased the endogenous auxin level that resulted in cell elongation which accelerated the development of fruits. Beneficial effects of NAA 25 ppm and GA_3 10 ppm were also recorded by Ghosh *et al*. (2009) for all the parameters in pomegranate. Significant increase in fruit weight was observed by Hussein *et al*. (1994) in pomegranate by using NAA 20 ppm. Adi and Prasad (2012) studied the positive influence of NAA on fruit length, breadth, volume and fruit weight in pomegranate cv. Ganesh. The poor response of cultivar Bhagwa under the study to GA_3 may be attributed to the different behaviour of the variety and the climatic conditions. The present investigations showed that, the aril parameters with respect to aril weight, aril per cent and seed:aril ratio were found significantly influenced by plant growth regulators. Between the two growth regulators, the NAA treatments showed a significant result as compared to GA_3. It was observed that application of NAA 40 ppm recorded maximum with regard to all the aril parameters followed by NAA 50 ppm. The least was observed under control. The increase in aril weight and aril per cent might be due to increased cell size and intercellular spaces coupled with accumulation of water, sugars and other soluble solids in greater amount as a result of translocation of metabolites towards the fruits. The beneficial effects of NAA 40 ppm was also recorded by Adi and Prasad (2012) in pomegranate cv. Ganesh.

Table 1. Effects of plant growth regulators on fruit set and yield of pomegranate cv. Bhagwa

Treatments	Days taken for fruit set	Yield			Fruit			
		Number	Kg/plant	Kg/ha	Length (cm)	Diameter (cm)	Weight (g)	Volume (ml)
T_1-Control (Water spray)	40.66	45.00	8.14	7540.73	4.48	5.01	181.00	178.32
T_2-NAA 40 ppm	37.55	62.44	16.45	15232.70	8.66	8.71	262.23	255.44
T_3-NAA 50 ppm	38.22	60.11	15.06	13942.47	8.42	8.46	250.43	249.85
T_4-NAA 60 ppm	38.55	50.55	11.90	11022.49	8.37	8.45	235.57	234.74
T_5-GA_3 40 ppm	39.66	50.44	11.25	10417.50	6.91	7.22	223.10	217.44
T_6-GA_3 50 ppm	39.44	47.33	9.91	9173.57	6.73	7.24	209.57	211.37
T_7-GA_3 60 ppm	39.89	50.66	11.23	10395.89	7.64	7.54	221.67	218.48
S.Em±	2.64	2.76	0.77	713.56	0.36	0.37	3.78	6.86
C.D. @ 5%	8.14	8.51	2.37	2198.68	1.11	1.14	11.64	21.12

Table 2. Effects of plant growth regulators on aril and seed parameters of pomegranate cv. Bhagwa

Treatments	Aril weight (g)	Aril (%)	Seed:Aril ratio	Seed number	100 seed weight	Seed (%)
T_1-Control (Water spray)	104.70	57.84	0.04	302.67	4.38	2.49
T_2-NAA 40 ppm	188.90	72.03	0.02	269.60	3.09	0.84
T_3-NAA 50 ppm	175.77	70.19	0.02	271.33	3.16	0.92
T_4-NAA 60 ppm	160.73	68.23	0.02	280.00	3.18	1.01
T_5-GA_3 40 ppm	150.70	67.55	0.02	274.67	3.20	1.34
T_6-GA_3 50 ppm	135.80	64.80	0.03	294.00	4.05	1.74
T_7-GA_3 60 ppm	148.53	67.01	0.03	281.67	4.19	1.82
S.Em±	4.04	2.60	0.00	9.28	0.06	0.09
C.D. @ 5%	12.46	8.00	0.01	28.58	0.19	0.26

Table 3. Effects of plant growth regulators on quality characters of pomegranate cv. Bhagwa

Treatments	Total Soluble solids (°Brix)	Reducing sugars (%)	Non-reducing sugars (%)	Total sugars (%)	Physiological loss in weight (%)	Shelf life (Days)
T_1-Control (Water spray)	14.14	12.16	1.45	13.61	33.83	20.53
T_2-NAA 40 ppm	16.76	13.83	1.75	15.58	26.17	29.00
T_3-NAA 50 ppm	15.34	13.79	1.72	15.51	26.59	23.40
T_4-NAA 60 ppm	14.69	13.40	1.67	15.07	27.32	22.47
T_5-GA_3 40 ppm	14.63	12.79	1.63	14.42	27.38	21.67
T_6-GA_3 50 ppm	14.55	12.76	1.62	14.38	26.33	22.23
T_7-GA_3 60 ppm	14.48	13.01	1.64	14.65	27.07	21.40
S.Em±	0.18	0.31	0.03	0.07	0.36	0.49
C.D. @ 5%	0.56	0.96	0.08	0.21	1.10	1.50

In the present study, the results obtained under the NAA treatments found significant with respect to number of seeds, 100 seed weight and seed per cent. Application of NAA 40 ppm recorded minimum number of seeds followed by GA_3 treatments. These results are in line with reports of Shailendra and Dikshit (2010) in sapota cv. Cricket Ball where they have used NAA 100 ppm.

Similar trend was also observed with respect to 100 seed weight. The minimum seed weight was observed under the treatment NAA 40 ppm followed by 50 ppm and was maximum in control treatment. Thus physical quality of fruit was improved with the use of plant growth regulators. NAA 40 ppm reduced the weight of 100 seeds from 4.38 g to 3.09 g. This might be due to parthenocarpic fruit development stimulated by the growth regulator spray. Similar results were obtained in guava by Ashotosh *et al*. (2013), Shailendra and Dikshit (2010) in papaya and Abdodali and Gholamreza (2010) in date palm. Application of NAA at 40 ppm reduced the seed per cent from 2.49 to 0.84. Similar results are reported in phalsa by Kacha *et al*. (2012) and in guava by Ashutosh *et al*. (2013) by using different concentrations of NAA. The data pertaining to the quality characters are presented in Table 3 indicated that the differences due to various PGRs were found to be significant. The higher total soluble solids was observed in the treatment NAA 40 ppm, followed by NAA 50 ppm, while the lowest was recorded in control. The increased total soluble solids might be due to the quick metabolic transformation of starch and pectin into soluble compounds and rapid translocation of sugars from leaves to developing fruits. The similar results were obtained by Ghosh *et al*. (2009) in cv. Ruby in pomegranate, Sharma *et al*. (2005) in litchi and Chavan *et al*. (2009) in sapota. Among the different treatments, application of NAA 40 ppm resulted in increase in reducing, non-reducing and total sugars, while the decrease was reported under control treatment. The significant improvement in sugars might be due to better formation and translocation of carbohydrates which improved the fruit quality. These results are in line with Hussein *et al*. (1994) and Venkatesan and Kader (1994) in pomegranate with 10 ppm and 25 ppm of NAA was used. The minimum physiological loss in weight was observed in the treatment NAA 40 ppm from four days of harvest to 20 days. The maximum physiological loss in weight was observed in control treatment (Table 3). The possible reason for the reduced weight loss by growth regulators might be due to cause some chemical changes within the fruits, resulting in retention of more water against the rate of evaporation. Further, it may be possibly due to the alteration of some proteinous constituents of the cell and thus increase in affinity towards water. Similar result was reported by Kher and Bhat (2005) in guava. Maximum shelf life of fruits was recorded in NAA 40 ppm followed by NAA 50 ppm and minimum was observed under control treatment. This might be due to chemical changes within the fruits resulted in retention of more water against the rate of evaporation. This result was in line with Ghazzawy (2013) in date palm cv. Barhee.

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