The Pharma Innovation Journal 2021; 10(2): 487-489

www.ThePharmaJournal.com

The Pharma Innovation

ISSN (E): 2277- 7695
ISSN (P): 2349-8242
NAAS Rating: 5.03
TPI 2021; 10(2): 487-489

www.thepharmajournal.com
Received: 16-12-2020
Accepted: 18-01-2021

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Effect of GA_3 and 2, 4-D on vegetative growth and yield of pomegranate (*Punica granatum* L.) cv. Bhagwa

Shri Kant Bharty, Sutanu Maji and Som Prakash

Abstract
Pomegranate (*Punica granatum* L.) is belongs to family punicaceae having high nutritional values. An experiment was conducted at Horticulture Research Farm, Department of Horticulture, Babasaheb Bhimrao Ambedkar University, Lucknow during 2016-2017, to studied the effect of GA_3 and 2,4-D on vegetative growth, yield and quality of pomegranate cv. Bhagwa. The experiment was comprised nine treatments and laid out in randomized block design with three replications. The treatment consisted of three levels of GA_3 (20, 30 and 40@ppm) and 2,4-D (5, 10 and 15@ppm) and control. The observed significant effect of different levels of GA_3 and 2,4-D on plant vegetative growth traits of pomegranate. The maximum plant height (186 cm), basal girth (30.44 cm), canopy spreading East-West (152.67cm), North-South (150.00 cm) secondary branches recorded T_7 (118.0 cm), number of fruit set (72.33), number of fruit per plant (63.66), fruit yield plant per kg (6.03kg), fruit yield qt per ha (24.10 q/ha) was recorded under treatment T_7. However, the maximum number of primary branches (5.33) was recorded under treatment T_8. Therefore, the study suggested for combined foliar application of GA_3 + 2,4-D (30@ppm+10@ppm) for better plant growth, yield and fruit quality of pomegranate cv. Bhagwa in Lucknow subtropical condition.

Keywords: pomegranate, (*Punica granatum* L.), GA_3, 2, 4-D and Bhagwa

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) [14, 15]. Though, it is native of Iran but cultivated extensively in Mediterranean and central Asian countries. It is highly suitable for growing under arid and semi - arid 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.
The plant growth regulators (PGR) act as messengers and are needed in small quantities at low concentrations. Generally their site of action and biosynthesis are different. Most of the plant growth regulators exhibit a broad spectrum and thus a single PGR may influence several entirely different processes. Moreover, plant growth regulators enhance the rapid changes in physiological and biochemical characters and improve crop productivity. Gibberellics acid has been reported to influence vegetative growth, flowering, fruiting and various disorders in many fruit crops. It is also used widely in other horticultural crops for stimulating fruit set in various fruit species, such as peach, mandarin, pear, also to control apple russeting, and cracking of pomegranate fruit. Moreover, sprays of GA_3 have been widely adopted in commercial orchards because they have consistently been shown to increase fruit size and firmness of cherry. Moreover, GA_3 increased the yield of fruit and increases soluble solids as well as fruit weight. Furthermore, synthetic auxins are effective in enhancing fruit growth when applied during the second stage of fruit development. Many studies have intended to prevent fruit abscission in lychee using synthetic auxins, mainly 2,4-D (2,4-dichlorophenoxyacetic acid) and 2,4,5-T (2,4,5- trichlorophenoxyacetic acid). It was also reported that 2,4-D increased the fruit set and total sugar content and enhanced the activities of antioxidant enzymes. With the combination of 2,4-D and GA_3 application significantly reduced acidity percentage and increased vitamin-C content in fruits.

Although these references are available in the literature and the importance of synthetic plant growth regulators in achieving higher yield and better fruit 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, effect of GA_3 and 2,4-D on vegetative growth, yield and quality of pomegranate (*Punica granatum* L.) cv. Bhagwa.

Materials and Methods

The field investigation was carried out at Departmental of Hotriculture at Babashaheb Bhemrao Ambedkar University, Lucknow during year 2016-17. The soil type of the experimental plot is estimated as being saline having pH 8.2 and low organic carbon (Dived *et al*., 2012). It is located at 26^0 50'N latitude and 80^0 52'E longitudes. The experiment was laid out in a randomized block design with three replications. The experiment comprised of nine treatments as T_1 2,4-D@5ppm, T_2-2,4@10ppm, T_3-2,4-15ppm, T_4-GA_3@20ppm, T_5-GA_3@30ppm, T_6-GA_3@40ppm, T_7-2,4@10ppm + GA_3@30ppm, T_8-2,4-D @15ppm + GA_3 40ppm and T_0 control (water spray). Plant growth regulators were applied to plants by spraying before flowering and after fruit set. The observations on the growth characters in terms of plant height, canopy spreading East-west and North-South, was measured with the help of measuring tape in centimetres. Plant girth of the plants was measured in centimeters at 4cm above the ground level with the help of Vernier's calliper. The primary branch, secondary braches, number of fruit set, number of fruit per plant was observed fruit yield, fruit yield qt per ha the plants were made a month before and after the spray of the growth regulators. The total number of fruits picked per plants was counted and weighed. The yield (g/plant) was calculated on the basis of product of average fruit weight and the total number of fruits per plant The observed data were analyzed statistically using analysis of variance as formulated at 5% level of significance (Sahu and Das, 2014) [16].

Result and Discussion

Effect of GA_3 and 2,4-D on vegetative growth and yield of pomegranate cv. Bhagwa

The experimental finding (Table) indicated that application of 2,4-D@10ppm in combination with GA_3@30ppm (T_7) increased the plant height at maximum level fallowed by application GA_3@40ppm, but they were statistically at per. Among the various treatments of bio-regulators GA_3 @20ppm (T_4) caused increased the plant height over the control plant. Which showed the lowest plant height. In case of basal girth T_4 (GA_3 @20ppm) recorded the maximum basal girth fallowed by T_7 (2,4-D@10ppm + GA_3@30ppm). However statistically analysis clearly indicated that the change in basal girth was the non-significant due to different treatments.

The canopy spiriting in both the direction (E-W, N-S) was recorded maximum in plants treated with 2,4-D@10ppm along with GA_3@30ppm (T_7) fallowed by the treatment of GA_3@20ppm (T_4).

The table1also showed that the variation of number of primary and secondary branches per plant did not various significantly with various bio regulator treatment. However, maximum number of branches (both primary and secondary) was recorded treatment (T_8) i.e. application of 2,4-D@15ppm along with GA_3@10ppm.

Table 1: Effect of GA_3 and 2, 4-D vegetative growth and yield of pomegranate cv. Bhagwa

Treatment	Plant height (cm)	Basal girth (cm)	Canopy spreading (cm)		Number of branches		Number fruit set	Number of fruit drops	Number of fruit per plant	Fruit yield plant per (kg)	Fruit yield kg per ha
			East-west	North-south	Primary	Secondary					
T_0 - Control	113.33	23.71	98.67	91.67	3.33	92.00	2.00	0.33	3.33	0.17	0.64
$T_1$2,4-D@ 5ppm	175.33	30.49	152.00	148.67	3.33	102.00	58.67	1.00	35.33	2.31	9.25
T_2 2,4-D@ 10ppm	167.33	30.35	151.33	147.00	5.33	112.00	56.00	1.67	36.33	3.01	12.04
T_3 2,4-D @15 ppm	170.67	26.61	150.67	148.33	3.33	112.33	52.00	2.00	38.33	4.23	14.48
T_4 GA_3@ 20ppm	121.33	29.84	94.33	93.67	2.33	95.67	24.33	0.33	28.33	2.98	11.90
T_5 GA_3 @30ppm	180.67	30.06	140.67	134.67	3.67	96.00	44.00	1.33	40.33	2.79	11.16
T_6 GA_3@ 40ppm	181.67	24.24	137.33	142.00	3.67	98.33	46.33	1.67	46	2.57	10.27
T_7 2,4-D@10ppm + GA_3-D@ 30ppm	186.00	30.44	152.67	150.00	3.33	118.00	72.33	0.00	63.66	6.03	24.10
T_8 2,4-D @20ppm + GA_3-D@ 40pmm	127.33	27.35	102.67	101.67	5.33	125.00	58.67	3.00	12.67	1.16	4.63
SE m **(±)**	7.27	2.92	6.85	5.74	1.96	9.81	5.86	0.41	3.9	0.35	11.91
CD at 5%	21.99	N/A	20.71	17.36	N/A	N/A	17.72	1.263	11.79	1.07	36.02

Application of 2,4-D and GA_3 along or in combination significantly improved the fruit set in compression to control condition. The fruit set number per plant was recorded maximum in the treatment 2,4-D application at 10ppm. In combinations with GA_3 at 30ppm (T_7) which decreased the fruits per plants. It was also found that high rate of 2, 4-D 15@ppm and GA_3 at 40@ppm (T_8) increased the dropping of fruit even more than control. Which decreased the harvestable number of fruit per plant significantly. But the minimum fruits where harvested from control plant.

The treatment T_7 (2,4-D@10ppm+ GA_3@30ppm) also increased the weight of fruit at maximum level among the various treatment while, control plants showed the lowest fruit weight.

The maximum number of fruit per plant and highest average fruit weight resulted the maximum fruit yield (plant per kg as well as yield per ha.). Which was estimated as highest under treatment (T_7) when the plant where treated with 2,4-D@10ppm and GA_3@40ppm fallowed by treatment T_6 i.e. application of GA_3@40ppm at the lowest yield was recorded under control plant.

Conclusion

In the present investigation, is clearly indicated that foliar use

of GA_3 and 2,4-D improved the performance of pomegranate in general in respect of vegetative growth decreased flower and fruit drop and there by increased fruit yield as well as quality of fruits. Therefore it may be conducted that combined application of 2,4-D@10ppm, with GA_3@30ppm as foliar spray was found to be the best among all the treatments for better quality of pomegranate cv. Bhagwa grown under Lucknow sub-tropical area.

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