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Efficacy of Pruning Intensities and Nutrients Spray on Growth and Quality Parameters of Pomegranate (*Punica granatum* L.) cv. Bhagwa

Yuvraj Yadav[1], Rajnee Sharma[2*] and T.R. Sharma[3]
[1]M.Sc. (Fruit Science), Department of Horticulture, College of Agriculture, JNKVV, Jabalpur (Madhya Pradesh), India.
[2]Assistant Professor, Department of Horticulture, JNKVV, Jabalpur (Madhya Pradesh), India.
[3]Professor, Director of Extension Services, JNKVV, Jabalpur (Madhya Pradesh), India.

(Corresponding author: Rajnee Sharma)*
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ABSTRACT: A field experiment entitled efficacy of pruning intensities and nutrients spray on growth and quality parameters of Pomegranate (*Punica granatum* L.) cv. Bhagwa was conducted at Fruit Research Station, Imaliya, Department of Horticulture, Jawaharlal Nehru Krishi Vishwa Vidyalaya, Jabalpur (M.P.) during 2020-21. Total of 20 treatments combinations of pruning intensity and foliar spray of nutrient were arrange in AFRBD. The pruning intensity and foliar spray of nutrients significantly influence the growth and chemical composition of fruits. The maximum plant height (40.64 cm), shoot length (32.51cm), shoot diameter (2.59 mm) at 90 days after pruning and minimum days taken to first flowering (98.60 days), to first fruit set (115.47 days) and highest number of flowers per shoot (7.21) were recorded under pruning at 20 cm whereas, maximum juice content (52.27 %), TSS (15.32 °Brix), reducing sugar (12.35 %), total sugars (12.93 %) and minimum non-reducing sugar (0.87 %), and acidity (0.36 %) were recorded under pruning at 60 cm. Similarly, the foliar spray of nutrient bring out significant changes in the growth and quality parameters of the fruits and maximum plant height (39.40 cm), shoot length (30.96), shoot diameter (2.57 mm) at 90 days after pruning and least days were taken to first flowering (100.17), to first fruit set (118 days) and higher number of flowers per shoot (6.58) as well as higher value of juice contain (51.93%), TSS (15.37 ^{0}B), reducing sugar (11.74 %), total sugars (12.91 %) and minimum value of non-reducing sugar (0.98 %) and acidity (0.41%) were recorded under the application of 2% Urea + 0.4% Zn + 0.4% B. As regarded, the interaction effect of pruning intensities and foliar application of nutrients showed significant effect on the growth and quality parameters of the fruits and the maximum plant height (47.84 cm), shoot length (34.93 cm), shoot diameter (2.66 mm) were recorded at 90 days after pruning as well as minimum day to first flower (95 days), to first fruit set (112.33 days) and maximum number of flowers per shoot (7.80), were recorded with 20 cm pruning in combination with 2% Urea + 0.4% Zn + 0.4% B. As regard the chemical composition of fruit the maximum juice content (55.00 %) and TSS (15.80 °Brix) were recorded under treatment 60 cm pruning along with the foliar spray of Urea (2%) + Zn (0.4%) + B (0.4 %). The quality parameter *viz.*, acidity (0.30%), reducing sugar (12.91 %), non-reducing sugar (0.74 %), total sugars (13.96 %) were recorded under treatment 60 cm pruning along with the foliar spray of Urea (2%) + Zn (0.4%) + B (0.4 %) and did not differ significantly.

Keywords: Growth, Pomegranate, Quality, Bahar.

INTRODUCTION

Pomegranate is an important fruit crop of arid zone. It is fruitful in dry land and tropics and sub tropics region. The area under pomegranate cultivation is about 262 thousand ha with production of 3034 thousand MT. In MP, pomegranate is covering an area of 9675.20 ha with the production of 114266.29 tons with an average productivity of 11.81 tons/ha (Anonymous, 2018). Three flowering seasons *i.e.*, *Ambe Bahar* (January - February), *Mrig Bahar* (June - July), and *Hast Bahar* (September - October) have been observed in India (Radha and Medhew 2007). *Ambe Bahar* is mostly common and adopted by the growers due to higher growth and better quality of fruits. The flowers are borne on current year's growth and found mostly in clusters either terminally or in axils of the leaves. Three types of colorful orange-red flowers *viz.* male flowers (bell-shaped), hermaphrodite flowers (vase-shape) and intermediate flowers are found (Radha and Medhew 2007). The plant are hardy nature, low maintenance cost, better fruit quality and survival without irrigation make pomegranate cultivation a paying proposition. Nitrogen is an important nutrient for the vegetative growth of the plant, and the deficiency of nitrogen resulted light green to yellow foliage over entire tree. Boron deficiency resulted serious issue such as growth cease at the growing point and poor development of roots, premature shading of male flowers and impaired

pollen tube development leading to poor fruit setting and fruit cracking (Singh *et at.*, 2003). Zinc deficiency resulted reduce leaf and shoot growth, reduction in flowering and fruit setting (Wiedenhoeft, 2006). If pomegranate suffer from malnourishment, they indicate warning sign of be unhealthy and poor fruit quality. So, for taking the better-quality fruits with proper chemical properties we must need to supply good quality of the chemicals as per the requirements.

MATERIAL AND METHODS

An experiment was conducted during the year 2020-21 at Fruit Research Station, Imaliya, Department of Horticulture, JNKVV, Jabalpur (M.P.). Four treatments of 0, 20, 40 and 60 cm pruning intensities were selected along with five nutrient application treatments viz. Urea + Zn + B with different concentration combinations. The randomly selected plants were tagged and as per the treatments the shoots were pruned in the month of November at 0 cm (unpruned), 20 cm, 40 cm, and 60 cm levels with the help of secateur. As per treatments the nutrient were sprayed twice during the trial period. The first foliar spray of nutrient was applied in the month of December and the second was 30 days after the first spray *i.e.*in the month of January. Without spray and no pruning fruit plants were treated as control. The experiment was conducted out in Asymmetrical Factorial RBD with three replications. There were twenty treatments in each replication. Total 60 plants were randomly selected and tagged. Single tree was considered as an experimental unit. Plant height was measured in cm using graduated flagstaff from the ground surface to the tip of the central leader once just after pruning and at harvest of crop. The height gain was computed in cm by subtracting the initial values from final values. Vernier scale was used for measuring the value of shoot length in cm and shoot diameter in mm. Number of days counted from the date of pruning as floral bud appearance was noted for first flowering. The total number of flowers per shoot was counted. Days of fruit set from the date of pruning was considered as first fruit set. The juice collected from arils was measured in the measuring cylinder then dividing the volume by weight of arils gives juice percentage. TSS of the randomly selected fruits was determined by using an Erma-Hand refractometer (0 to 32 ^{o}B). Titrable acidity content of samples was determined by simple acid-alkaline titration method as described in AOAC (1980), end point reading was recorded and the percentage acidity was calculated in terms of citric acid. Reducing sugar was calculated in terms of Fehling factor and titrate value. The total sugar content was expressed as percentage of juice weight as per method of A.O.A.C. (1980) by dilution. The amount of non-reducing sugar was obtained by subtracting reducing sugar from the amount of total sugar and multiplying the resultant by a factor 0.95 as given in AOAC (1980).

RESUTLS AND DISCUSSION

The data regarding growth and chemical compositions presented in Table 1 and 2 revealed that the pruning intensity and foliar spray of nutrients significantly influence the plant height, shoot length, shoot diameter, first flowering, number of flowers per shoot and first fruit set over the control also the quality characters of the fruit like juice percentage, TSS, acidity, reducing sugar, non-reducing sugar and total sugars.

Pruning Intensity: Pruning intensities significantly influences the growth and quality parameters of the fruits the significantly higher plant height (40.64 cm), maximum shoot length (17.30, 25.54 and 32.51 at 30, 60, and 90 days after pruning respectively), maximum shoot diameter (1.18, 1.72 and 2.59 mm at 30, 60 and 90 days after pruning respectively), highest number of flowers per shoot (7.21) and minimum days taken to first flowering (98.60 days) and to first fruit set (115.47 days) were recorded under plant pruned at 20 cm. The improvement in these parameters might be due to pruning remove the carbon starved, promote new growth to build up carbohydrates reserve, allows the sprouting of lateral buds which, ultimately influence plant growth and other vegetative characters due to quick response of the supply of the food material absorbed by the main trunk. These results are in accordance with the findings of Sharma *et al.* (1997) in new castle in apricot, Shaban and Haseeb (2009) in guava, Prabhakar *et al.* (2014) in guava. Whereas, pruning at 60 cm showed superiority among various intensity of pruning and value of quality parameters viz. juice contain (52.27 %), maximum TSS (15.32°B) reducing sugar (12.35 %), total sugars (12.93 %), and minimum non-reducing sugar (0.87 %), and acidity (0.36 %) were recorded. The improvement in chemical quality of fruit might be due to pruning intensity increase the light penetration inside the plant resulted increase the production of photosynthates and more metabolites supply for fruits. This result was conformity by Singh and Dhaliwal (2004) in guava, Kundu *et al.* (1995) in ber, Sheikh *et al.* (2002) in Pomegranate, Ghatul *et al.* (2019) in Pomegranate.

Nutrients application: Application of nutrients also bring out the significantly changes in the growth and quality parameters of the fruits and the data regarding this is given in Table 2. Growth parameters like higher plant height (39.40 cm), maximum shoot length (23.94 and 30.96 at 60 and 90 days after pruning respectively), maximum shoot diameter (1.68 and 2.57 mm at 60 and 90 days after pruning respectively), least days were taken to first flowering (100.17), highest number of flowers per shoot (6.58), minimum days taken to first fruit set (118 days) was recorded under the application of 2% Urea + 0.4% Zn + 0.4% B. The improvement and advancement in these parameters because of the combined application of Urea, Zn and B, and their proper availability to plant act as respiratory catalyst which, enhanced respiration rate, metabolic activity of plant, cell division, protein synthesis and the proper availability of photosynthates stimulate the growth rate and development of the plant. These results are in conformity with the result of Ullah *et al.* (2012) in 'kinnow' mandarin, Babu *et al.* (2007) in kagzi lime and Bhalerao *et al.* (2014) in Papaya they pointed out the application of macro and micro nutrient results in

improved vegetative growth parameters. In the case of quality characters, the quality parameters i.e., juice (51.93%), maximum TSS (15.37 °Brix), reducing sugar (11.74 %), total sugars (12.91 %) and minimum non-reducing sugar (0.98 %) and acidity (0.41%), were recorded with the foliar spray of Urea (2%) + Zn (0.4%) + B (0.4 %). The improvement in quality might be due to the higher conversion of organic acids into sugar due to quick metabolic transformation of the soluble compounds. This result was closely similar with the finding of Hafeez *et al.* (1999) in sweet orange, Lal and Sen (2001) in Guava cv. Allahabad Safeda, and Singaram and Prabu. (2001) in Grapes.

Pruning intensity and Nutrient application Among interaction effect of pruning and nutrient application it has considerable effect on the enhancement of chemical as well as growth parameters of pomegranate and the data regarding this is given in Table 1 and 2. The higher plant height (47.84 cm), maximum shoot length (27.00, and 34.93 cm at 60 and 90 days after pruning, respectively), maximum shoot diameter (1.76 and 2.66 mm at 60 and 90 days after pruning, respectively), first flowering (95 days), highest number of flowers per shoot (7.80), minimum days taken to first fruit set (112.33 days) were recorded with 20 cm pruning in combination with 2% Urea + 0.4% Zn + 0.4% B. The results of quality parameters showed significant on juice (55.00 %), maximum TSS (15.80 ^{0}Brix) were recorded under treatment 60 cm pruning along with the foliar spray of Urea (2%) + Zn (0.4%) + B (0.4 %). Whereas, values of acidity (0.30 %), reducing sugar (12.91 %), non-reducing sugar (0.74 %), total sugars (13.96 %) were recorded under treatment 60 cm pruning along with the foliar spray of Urea (2%) + Zn (0.4%) + B (0.4 %). This value did not differ significantly with other combinations. Deeper pruning delayed the first flower, fruit set and flowers/shoot due to the juvenility is more at the base of the plant and it is gradual reduced in acropetal manner towards the distal end. This result was accordance with findings of Pawar *et al.* (1993) in pomegranate.

Table 1: Effect of pruning intensities and foliar application of nutrients on growth parameters of pomegranate.

Treatments	Plant height (cm)	Shoot length (cm)	Shoot diameter (mm)	First flower (days)	Number of flowers per shoot	Days to fruit set
Without pruning	26.99	24.16	2.40	108.27	4.23	127.73
Pruning @20cm	**40.64**	**32.51**	2.59	98.60	7.21	115.47
Pruning @40cm	33.95	27.15	2.43	100.73	6.91	120.53
Pruning @60cm	31.04	29.79	2.55	104.53	5.08	122.27
SE(m)±	0.28	0.09	0.003	0.26	0.02	0.25
CD at 5%	0.81	0.25	0.009	0.73	0.06	0.70
Without spray	26.07	24.30	2.36	106.50	4.89	125.92
Urea (2%) + Zn (0.2%) + B (0.2%)	36.77	29.64	2.53	101.00	6.25	119.75
Urea (2%) + Zn (0.4%) + B (0.4%)	**39.40**	30.96	2.57	100.17	6.58	118.00
Urea (4%) + Zn (0.2%) + B (0.2%)	31.56	28.30	2.49	104.08	5.68	122.25
Urea (4%) + Zn (0.4%) + B (0.4%)	31.98	28.82	2.51	103.42	5.89	121.58
SE(m)±	0.31	0.10	0.004	0.29	0.02	0.27
CD at 5%	0.90	0.28	0.010	0.82	0.06	0.79
Control (P_0S_0)	21.67	20.43	2.20	111	3.25	130.33
Without pruning + Urea (2%), Zn (0.2%) + B (0.2%)	29.62	25.14	2.44	107	4.49	126
Without pruning + Urea (2%), Zn (0.4%) +B (0.4%)	31.34	26.20	2.48	106.67	4.90	125.33
Without pruning + Urea (4%), Zn (0.2%) + B (0.2%)	25.96	24.23	2.42	108.67	4.20	128.67
Without pruning + Urea (4%), Zn (0.4%) + B (0.4%)	26.36	24.80	2.44	108	4.30	128.33
20cm pruning + Without spray	32.68	28.30	2.50	102.33	6.37	120
20cm pruning + Urea (2%), Zn (0.2%) + B (0.2%)	44.43	34.10	2.63	96	7.63	113.67
20cm pruning + Urea (2%), Zn (0.4%) + B (0.4%)	**47.84**	34.93	2.66	95	7.80	112.33
20cm pruning + Urea (4%), Zn (0.2%) + B (0.2%)	38.68	32.20	2.58	100	6.97	116.33
20cm pruning + Urea (4%), Zn (0.4%) + B (0.4%)	39.56	33	2.60	99.67	7.27	115
40 cm pruning + Without spray	26.75	23.07	2.32	105.67	5.93	126
40 cm pruning + Urea (2%), Zn (0.2%) +B (0.2%)	38.34	28.30	2.45	98	7.30	118.67
40 cm pruning + Urea (2%), Zn (0.4%) + B (0.4%)	41.35	30.00	2.52	97	7.60	116.33
40 cm pruning + Urea (4%), Zn (0.2%) + B (0.2%)	32.97	27.00	2.43	102	6.73	121
40 cm pruning + Urea (4%), Zn (0.4%) + B (0.4%)	30.34	27.40	2.44	101	6.97	120.67
60 cm pruning + Without spray (P_3S_0)	23.19	25.50	2.43	107	4.00	127.33
60 cm pruning + Urea (2%), Zn (0.2%) + B (0.2%)	34.67	31.02	2.60	103	5.57	120.67
60 cm pruning + Urea (2%), Zn (0.4%) +B (0.4%)	37.05	32.71	2.62	102	6.00	118
60 cm pruning + Urea (4%), Zn (0.2%) + B (0.2%)	28.64	29.77	2.53	105.67	4.80	123
60 cm pruning + Urea (4%), Zn (0.4%) + B (0.4%)	31.67	30.07	2.55	105	5.03	122.33
SE(m)±	0.63	0.20	0.007	0.57	0.05	0.55
CD at 5%	1.80	0.56	0.021	1.64	0.13	1.57

Table 2: Effect of pruning intensities and nutrient application on chemical composition of pomegranate.

Treatments	Juice (%)	TSS (^{0}B)	Acidity (%)	Total sugars (%)	Reducing sugars (%)	Non-Reducing sugars (%)
Without pruning	47.14	14.20	0.53	10.67	9.56	1.35
Pruning @20cm	49.25	14.84	0.46	12.33	11.12	1.28
Pruning @40cm	51.07	15.10	0.44	12.65	11.52	0.97
Pruning @60cm	52.27	15.32	0.36	12.93	12.35	0.87
SE(m)±	0.15	0.025	0.01	0.12	0.05	0.04
CD at 5%	0.42	0.073	0.03	0.34	0.13	0.12
Without spray	47.48	13.95	0.50	11.54	10.74	1.20
Urea (2%) + Zn (0.2%) + B (0.2%)	51.42	15.18	0.44	12.39	11.30	1.09
Urea (2%) + Zn (0.4%) + B (0.4%)	51.93	15.37	0.41	12.91	11.74	0.98
Urea (4%) + Zn (0.2%) + B (0.2%)	49.25	14.83	0.45	11.78	10.87	1.16
Urea (4%) + Zn (0.4%) + B (0.4%)	49.58	14.99	0.45	12.11	11.04	1.15
SE(m)±	0.17	0.028	0.01	0.13	0.05	0.05
CD at 5%	0.48	0.081	0.02	0.38	0.15	0.13
Control (P_0S_0)	45.33	12.90	0.56	10.07	9.27	1.53
Without pruning + Urea (2%), Zn (0.2%) + B (0.2%)	47.83	14.60	0.52	11.02	9.67	1.25
Without pruning + Urea (2%), Zn (0.4%) +B (0.4%)	48.20	14.80	0.50	11.32	10.12	1.19
Without pruning + Urea (4%), Zn (0.2%) + B (0.2%)	47.00	14.30	0.54	10.44	9.32	1.36
Without pruning + Urea (4%), Zn (0.4%) + B (0.4%)	47.33	14.40	0.53	10.51	9.43	1.40
20cm pruning + Without spray	47.27	14.00	0.49	11.39	10.46	1.12
20cm pruning + Urea (2%), Zn (0.2%) + B (0.2%)	50.83	15.13	0.45	12.63	11.30	1.32
20cm pruning + Urea (2%), Zn (0.4%) + B (0.4%)	51.17	15.27	0.42	12.95	11.88	1.15
20cm pruning + Urea (4%), Zn (0.2%) + B (0.2%)	48.33	14.83	0.48	12.27	10.81	1.46
20cm pruning + Urea (4%), Zn (0.4%) + B (0.4%)	48.67	14.97	0.47	12.43	11.12	1.34
40 cm pruning + Without spray	48.00	14.33	0.48	12.09	11.03	1.06
40 cm pruning + Urea (2%), Zn (0.2%) +B (0.2%)	53.00	15.37	0.42	12.96	11.70	0.97
40 cm pruning + Urea (2%), Zn (0.4%) + B (0.4%)	53.33	15.60	0.40	13.41	12.05	0.83
40 cm pruning + Urea (4%), Zn (0.2%) + B (0.2%)	50.33	15.00	0.45	12.30	11.33	0.97
40 cm pruning + Urea (4%), Zn (0.4%) + B (0.4%)	50.67	15.20	0.44	12.50	11.47	1.00
60 cm pruning + Without spray	49.33	14.57	0.46	12.61	12.19	1.07
60 cm pruning + Urea (2%), Zn (0.2%) + B (0.2%)	54.00	15.63	**0.35**	**12.96**	**12.53**	**0.83**
60 cm pruning + Urea (2%), Zn (0.4%) +B (0.4%)	55.00	15.80	**0.30**	**13.96**	**12.91**	**0.74**
60 cm pruning + Urea (4%), Zn (0.2%) + B (0.2%)	51.33	15.20	**0.34**	**12.13**	**12.00**	**0.84**
60 cm pruning + Urea (4%), Zn (0.4%) + B (0.4%)	51.67	15.40	**0.35**	**13.00**	**12.13**	**0.87**
SE(m)±	0.33	0.057	**0.02**	**0.27**	**0.10**	**0.09**
CD at 5%	0.95	0.162	**NS**	**NS**	**NS**	**NS**

Foliar application of nutrients resulted improved in flowering and fruiting characters, whereas, increase in the concentration of nutrients also increase the period of first flower and fruit set. This might be due to Nitrogen enhance the protein synthesis and cell division to promote new growth. The application of Boron enhances the viability and fertility of pollen grains and Zinc enhances enzymatic activity, source sink relationship of plant which favoring the flowering and fruiting characters. This result was similarly with the finding of Marathe *et al.* (2017) in pomegranate, Tanuja *et al.* (2016); Dhurve *et al.* (2018) in Pomegranate. The improvement in quality might be due to the higher conversion of organic acids into sugar due to quick metabolic transformation of the soluble compounds. This result was closely similar with the finding of Hafeez *et al. (*1999) in sweet orange, Lal and Sen (2001) in Guava cv. Allahabad Safeda, and Singaram and Prabu (2001) in Grapes.

CONCLUSIONS

All the pruning intensities and nutrient application of treatments were found better than control in terms of growth and chemical characteristics of fruit. The pruning intensity of 20 cm was found superior to increase the growth parameters of the fruits and the pruning intensity of 60 cm was found superior for quality parameters of the fruits. As regards to nutrients, then the application of Urea (2%) + Zn (0.4%) + B (0.4%), was found to be superior for both the growth and quality parameters of the fruits. Among the interaction the pruning intensity of 20 cm along with the application of 2% Urea+0.4% Zn+0.4% B, was found to be superior for the growth parameters of the fruits and the treatment pruning at 60 cm along with the application of 2% Urea+0.4% Zn+0.4% B, was found superior to increase the chemical parameters of the fruits.

FUTURE SCOPE

In future this study can be exploited commercially to increase quality and production of pomegranate.

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Conflicts of Interest. None.

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