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Response of plant density on growth, yield and quality of Pomegranate cv. Ganesh

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Abstract

An experiment on response of planting density on growth, yield and quality of pomegranate cv. Ganesh was conducted during 2001 to 2004 in the Experimental field of Central Horticultural Experiment Station, Vejalpur, Panchmahals, Gujarat under JVG-NATP-HFNS project. Pomegranate variety cv. Ganesh was planted at four different spacing levels i.e. 5m x 5m (T_1), 5m x 3m (T_2), 4m x 2m (T_3) and 2.5m x 2.5m (T_4) having density of 400, 666, 1250 and 1600 plants per ha, respectively in randomized block design with five replications purely under rainfed conditions of hot semi-arid ecosystem. Maximum plant height was recorded with planting density 2.5 m x 2.5m, while plant spread and stem girth was observed with 5m x 5m spacing during 3rd year. With regard to spacing, yield (3680 kg) per ha was recorded the maximum with plant density 2.5m x 2.5m, whereas size (6.50 cm x 6.90cm) of the fruit and quality characters were recorded the maximum in the planting density 5m x 5m under rainfed conditions of semi-arid ecosystem of western India.

Key words: *Pomegranate, density, yield, quality*

Introduction

The pomegranate is commercially grown for sweet and delicious taste. The versatile adaptability, hardy nature, low maintenance cost, steady and high yield, fine table and therapeutic value, better keeping quality and possibilities to thrive in the rest period when irrigation potential is generally low, are the main feature responsible for its spread on wide scale in varied edepho-climatic and soil conditions particularly under semi arid ecosystem of the country (Khodake *et al.*, 1990 and Prasad and Banker, 2000).

Planting density is the important yield-contributing factor, which can be manipulated to attain the maximum production per unit area. High-density orcharding makes maximum use of land to achieve high yield in early period of orchard life. Such orchards ensure better utilization of land labour, fertility, pesticides, solar radiations and high yield. In present scenario, closer spacing is need of hours to harvest high production per unit area. Extensive studies have been conducted on these aspects in temperate fruit crops like apple and peach while very little work has been conducted on pomegranate under semi-arid ecosystem of Gujarat. With growing emphasis on high productivity per unit area, high density planting is already successful in mango (Ram and Shirohi, 1991). Spacing between the trees has significant effect on vegetative growth, fruit yield and quality. To get higher yield of quality fruits and maximum profit, there is a need to deter- mine proper density. Keeping these points in view, the present study was planned to investigate the response of planting density on growth, yield and quality of pomegranate Cv. Ganesh under semi-arid ecosystem of Gujarat.

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Material and Methods

The studies were conducted on uniformly grown trees of cv. Ganesh planted in 2000 at four different spacing viz, 5m x 5m, 5m x 3m, 4m x 2m and 2.5m x 2.5m which were replicated five times in randomized Block Design. The area is characterized by semi-arid hot climate. The annual potential evapotranspiration of the area ranges between 1500 to 1600 mm, whereas actual mean usual precipitation is about 831 mm. The mean monthly maximum temperature ranges from 26 and 42^{0}C, while the minimum monthly temperature varies between 10^{0}C and 26^{0}C. The observations on tree character like plant spread, root stock girth, scion girth, and plant spread were recorded in the last week of September every year. Two shoots in each direction of the plant were tagged to record the growth parameters viz, plant height, stem girth and plant spread. The experiment was laid out in randomized block design, which was replicated five times. The soil type was clay-to-clay loam with available N 153.00, P 8.53 and K 169.50 kg/ha, while pH and EC of the experiment soils were 7.80 and 0.12 dsm^{-1} respectively. The soil depth ranged from 0.75 to 1.0 meter, and is derived from mixed alluvial basalts, quartzite, granite, and having layers of limestone just below the soil depth. Uniform cultural practices were

followed during the course of study in all the trees. The data on qualitative characters were determined by the methods as suggested by AOAC (1990).

Results and Discussion

Effect of high density planting systems density on growth

Planting density had no significant effect on plant height, stem girth and scion girth of pomegranate plants during initial years. The maximum rootstock girth, scion girth were recorded within 5m x 5m (T1) spaced plants while plant height was recorded the highest in the 2.5m x 2.5m (T4) spacing during 4th year (Table-1). It is established fact that plant grows towards the light with increase with the number of trees per hectare, increase in the height may be due to the competition for light nutrients, an availability of spaces for spread of branches, restricting the spreading of trees, but sufficient open space is available to grow upwards resulting taller trees. However in wider spacing owing to increase in the availability of light thereby carbohydrates reserves resulted in vigours growth of the trees. The results in agreement of the findings of Rathore et al. (2003), Mahajan et al. (2005), Stamper *et al.* (1996) and Ram and Sirohi (1991) in litchi, guava, apple and mango, respectively. Plant spread was also observed maximum in the spacing of 5mx5m. Reduction in rootstock girth scion girth and plant spread in close spacing were observed due the competition for light, nutrient and water between the plants (Prasad and Banker, 2000; Chundawat *et al*., 1992).

Effect of planting systems and densities on yield

All the parameters of yield and yield attributing characters were influenced by different plant densities (Table 2). All the treatments failed to exert significant differences on yield per tree under different planting densities. However, yield per ha was significantly affected by different densities and it was recorded highest in plants spaced 2.5m x 2.5m (3680 kg/ha) followed 4mx 2m (3025 kg/ha) and the lowest was recorded in normal planting densities 5mx5m (1488 kg/ha). The increment in the yield in closer spacing is due to accommodation of more nuber of trees per unit area. These findings are in agreement with results of Rathore *et al*., 2003, Mahajan *et al*., 2005, Stamper *et al*., 1996 and Ram and Sirohi, 1991 in litchi, guava, apple and mango, respectively.

Effect of density on the quality attributes

Various planting system had profound effect on quality characters of pomegranate fruits under different planting system (Table 2). Physical parameters in terms of fruit weight (218.70g), fruit length (6.5cm) and fruit diameter (6.9cm) were recorded significantly maximum in under spacing 5m x5m and it was recorded lowest in closer spacing (2.5mx2.5m), but the differences among the treatments T1, T2 and T3 were found to be non significant up to 3th year orchard lifer. The tree with bigger dimension

Table 1. Effect different plant densities on growth parameters of pomegranate, cv. Ganesh .

Treatment (Spacing)	Stem girth (cm)			Plant height (cm)			Plant spread (cm)		
	2002	2003	2004	2002	2003	2004	2002	2003	2004
T_1 (5mX5m)	6.25	12.20	22.69	105.05	127.00	220.45	78.82	129.50	205.00
T_2 (5mX3m)	6.21	11.70	21.53	104.80	125.46	217.12	76.00	127.10	201.15
T_3 (4mX2m)	5.82	11.40	19.90	103.20	124.23	218.19	75.40	125.30	192.30
T_4 (2.5mX2.5m)	5.88	10.65	19.59	104.20	126.39	221.14	76.90	123.60	189.00
C.D. (5%)	NS	NS	1.85	NS	NS	3.00	NS	NS	8.30

Table 2. Effect plant density on qualitative attributes of pomegranate Cv. Ganesh.

Treatment Spacing	Yield /plant (kg)	Yield kg/ha	Fruit weight (g)	Fruit length (cm)	Fruit diameter (cm)	Juice (%)	T.S.S. (^{0}Brix)	Acidity (%)
T_1 (5mx5m)	3.72	1488	218.70	6.50	6.93	47.32	15.45	0.45
T_2 (5mx3m)	3.59	1725	217.00	6.35	6.76	45.22	15.25	0.43
T_3 (4m x2m)	3.12	3025	215.20	5.82	6.05	44.23	15.20	0.41
T_4 (2.5mx2.5m)	2.98	3680	213.04	5.71	5.92	43.07	15.40	0.44
C. D. at 5%	0.45	----------	4.03	0.47	0.52	2.37	NS	NS

and high leaf and fruit ratio, more availability of water, less competition for nutrients may be reasons to be larger fruits. This might be owing to and light in wider spacing during initial years. The present findings are in close conformity with the results reported by Anbu *et al*. (2001) in mango, Bal and Dhaliwal (2005) in guava. The quality of fruits in term of TSS, acidity and juice per cent were also estimated, but the differences for TSS and acidity among the treatment could not reach the level of significance. The fruit quality in terms of juice percent was observed highest in the plant given 5m x 5m spacing during the initial years. The reason for more juice content in wider spacing may be due to full exposure of trees to sun light to synthesis of photosynthatess, and more availability of nutrient and water (Singh *et al*., 2001, Singh and Singh, 2007, Pandey *et al*., 1997 and Gupta and Bist, 2005).

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