



Planting System cum High Density Planting in Guava (*Psidium guajava* L.) Growth Yield and Quality of cv. Sardar in Kymore Plateau of Madhya Pradesh

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Abstract

The present experiment was carried out at Fruit Research Station, Kuthulia, College of Agriculture, Rewa, Madhya Pradesh, India during the year 2005-06 to 2014-15. The results revealed that various planting system exhibited significant effect on growth, yield and quality parameters of Guava. The maximum tree heights were recorded (5.17 m) and highest canopy height (4.57 m) in double hedge row system. The maximum girth of root stock (60.43 cm) and girth of scion were recorded (48.56 cm) in square system of planting. Significantly maximum tree spread (mean of E-W and N-S) was recorded (E-W 10.26 m and N-S 10.20 m) followed by (N-S 6.70 m and E-W 6.49 m). The maximum yield (397.07 ha⁻¹) was estimated in double hedge row system followed by (339.7 ha⁻¹) in cluster planting system. The physico-chemical properties of fruits maximum length of fruit (6.46 cm) and width of fruit (6.96 cm) were recorded in double hedge row system. The maximum flesh percentage (97.89%) in square system. The seed percent (2.72%) in hedge row system. The minimum test weight (1.18 g) was found in hedge row system. The maximum TSS (12.40 °B) in square system. The maximum reducing sugar (5.10%) and the maximum non-reducing sugar (7.30%) in square system. The maximum acidity (0.39) was recorded in hedge row system.

Keywords: Planting system high density planting, guava, cv. Sardar

1. Introduction

Guava (*Psidium guajava* L.), a member of family Myrtaceae, native to tropical America, the apple of the tropics, is one of the most common fruits in India. Guava is considered as one of the wonderful, nutritionally valuable and remunerative fruit crop of the world. Its cultivation is getting popularity due to increasing international trade, better nutritional quality and recessing of its value-added products like jam, jelly, etc. Guava also requires 16 essential elements and the absence of one or more essential elements affects metabolic activities in plant, resulting the expression of deficiency symptoms (Singh and Singh, 2007). Guava fruit is rich in 'vitamin-C, minerals like calcium, iron and phosphorous with pleasant aroma and flavor (Dhaliwal and Dhillon, 2003).

The guava is an important sub-tropical fruit crop of India, which

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occupies an area of 255 ('000 Ha) and production 4080 ('000 MT). In India, Madhya Pradesh occupies the area of 28.44 ('000 Ha) and production 990 ('000 MT) with 18.78 mt ha⁻¹ productivity. (Anonymous 2017). Guava is grown in all parts of Madhya Pradesh (Singh, 2011). It has a great adaptability and wide range of climatic and soil conditions.

In general, guava is cultivated mainly through a traditional system, under which it is difficult to achieve desired levels of production because large trees provide low production per unit area and needs high labour inputs (Singh et al., 2003). Getting increased yield of guava per unit area can be made possible by increasing the plant population (Mitra et al., 1984). Ultra high density planting not only provides higher yield but also provides higher net economic returns per unit area in the initial years and also facilitates more efficient use of inputs (Reddy, 2004). One of the ways used for efficient and profitable land use is to work on tree spacing. Its basic function is to confine the exploitation zone of the plant with regard to light, water and nutrients so that the highest total yield potential can be reached in the smallest possible area (Singh, 2005). Studies on high-density planting in guava have increased reported by Lal et al. (1996) and Singh (2004).

The high-density planting system not only provide higher yield but also provides higher economic return per unit area. The combined effect of different planting system cum high density in variety Sardar (L-49) on growth, yield and quality development of guava have not been studied in Rewa region of Madhya Pradesh, therefore present experiment has been conducted.

2. Materials and Methods

2.1. Study site

The present experiment was carried out at Fruit Research Station, Kuthulia, Farm, JNKVV, College of Agriculture, Rewa (M.P.) during the year 2005-06 to 2014-15, under All India Co-ordinate Research Project on Sub-tropical fruits. The experimental site was situated in the N-E part of Madhya Pradesh at 240.31° North latitude and 810.15° East longitude

at an elevation of above 365.7 mean sea levels. The climate of this site is subtropical with minimum and maximum temperature ranged from 10 °C to 45 °C and with average annual rainfall of 1100 mm.

2.2. Method of data collection

The variety Sardar (L-49) were planted at 441m² plot size and experiment was laid out in a Randomized Block Design (RBD) having five planting system of guava such as (T₁) Square system (9 plant plot⁻¹ and 204 plant ha⁻¹), (T₂) Hedge row system (15 plant plot⁻¹ and 340 plant ha⁻¹), (T₃) Double hedge row system (20 plant plot⁻¹ and 453 plant ha⁻¹), (T₄) Paired planting (12 plant plot⁻¹ and 272 plant ha⁻¹), (T₅) Cluster planting system (16 plant plot⁻¹ and 362 plant ha⁻¹) were arranged in four replication. Ten guava fruits were randomly selected from per plant and harvested from each replication. The growth, yield and quality parameters were study in the terms of plant height (m), girth (cm), spread (m²), yield (qha⁻¹), length of fruit (cm), width of fruit (cm), flesh (%), seed (%), test weight of seed (100 seed in g), TSS (°B), reducing sugar (%), non-reducing sugar(%), acidity (%), etc. The plant growth, yield and physico-chemical characters are important in any type of production technology (Aulakh 2005, Pandey et al. 2007, Patel et al., 2007, Patel et al., 2011). Total soluble solid (TSS) was determined by portable refractor meter of 0-32° Brix range. The acidity was determined by titrating the juice against N/10 NaOH and expressed as per cent citric acid method given in AOAC (1995) and total sugars were analyzed as per method given by Lane and Eynon (1943). The data was statistically analyzed by method of analysis of variance using RBD as described by Panse and Sukhatme (1985).

3. Results and Discussion

3.1. Growth parameters

The result of present investigation revealed that growth, character has been presented in (Table 1). Significant results were reported, the highest plant height and canopy height of guava plants were not affected significantly under various planting system. The maximum plant height (5.17 m) was

Table 1: Studies on different planting system and plant density on growth of Guava plants cv. Sardar (2014-15)

Treatments	Height of plant (m)		Girth (cm)		Spread (m)	
	Plant	Canopy	Root stock	Scion	N-S	E-W
T ₁ : Square system	4.81	4.24	60.43	48.56	6.70	6.60
T ₂ : Hedge row system	5.12	4.49	58.54	48.23	6.67	6.61
T ₃ : Double hedge row	5.17	4.57	54.43	46.09	5.85	5.68
T ₄ : Paired Planting	4.92	4.33	59.83	48.37	6.41	6.49
T ₅ : Cluster Planting (cluster of four)	5.14	4.52	56.28	47.20	5.99	5.73
SEm±	0.21	0.11	1.13	1.2	0.13	0.15
CD (p=0.05)	0.48	0.25	2.56	2.81	0.31	0.34



recorded in double hedge row system followed by (5.14 m) cluster planting system. While the minimum plant height was recorded (4.81m) in square system of planting. The maximum canopy height (4.57 m) was recorded double hedge row system followed by (4.52 m) cluster planting system. The minimum (4.24 m) was in square system of planting. The maximum girth of root stock (60.43 cm) was recorded in square system followed by (59.83 cm) in paired planting system. The maximum plant spread (f and) was (mean of N-S 6.70m and E-W 6.60 m) was recorded in square system, followed by (N-S 6.67 m and E-W 6.61 m) in hedge row system. Whereas, minimum (N-S 5.85 m and E-W 5.68 m) in double

hedge row system). Similar finding was also reported by Biswas et al. (1989) in papaya, Kundu (2007) in guava, Lal et al. (2007) in guava cv. Sardar, Singh (2001) and Singh (2011) in guava.

3.2. Yield parameters

The cumulative study of 10years showed that (Table 2) the average yield of 10 years differed significantly. The maximum fruit yield (397.07 qha⁻¹) was recorded in double hedge row system followed by (339.78 qha⁻¹) in cluster planting system. The minimum yield (243.01 qha⁻¹) was recorded in square system of planting. These observations were in accordance to the Singh et al. (1980) in guava and Bishwas et al. (1989) in papaya.

Table 2: Studies on different planting system cum high density on yield of Guava cv. Sardar yield (kg plot⁻¹) during (2005-06 to 2014-15.)

Treat-ments	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11	2005-11-12	2012-13	2013-14	2014-15	Pooled Mean	q ha ⁻¹
T ₁	427.40	564.24	606.35	648.88	862.89	1464.91	1532.43	1462.14	1551.85	1598.56	1071.96	243.01
T ₂	718.30	807.90	933.59	940.88	1022.11	1988.22	1998.8	2095.16	2096.55	2099.10	1470.06	333.26
T ₃	858.53	895.12	1113.20	1160.65	1278.10	2281.53	2384.40	2460.73	2481.54	2601.50	1751.53	397.07
T ₄	602.63	747.99	719.83	842.12	856.75	1733.85	1844.10	1853.63	1874.67	1963.0	1303.85	295.58
T ₅	726.73	867.73	849.96	1073.38	956.23	2005.77	2119.12	2057.25	2158.0	2174.40	1498.85	339.78
SEm±	54.41	56.70	54.32	31.28	43.88	55.11	75.14	64.34	35.24	43.21	73.12	-
CD (p=0.05)	150.80	157.19	151.55	87.27	121.42	152.75	209.64	178.50	97.31	120.55	203.94	-

3.3. Quality parameters

The physico-chemical characteristics of the fruits (Table 3) revealed that the highest fruit length (6.61 cm) was recorded in square system followed by (6.55 cm) hedge row system. Whereas minimum (6.45 cm) in paired planting. The fruit width maximum (6.99 cm) was recorded in square system followed by (6.97 cm) hedge row system. The minimum (6.91 cm) in cluster planting system. The flesh percent maximum (98.28%) was recorded in hedge row system. The maximum (2.72%) was recorded in hedge row system. The minimum seed per-cent (2.11%) was recorded in square system. This

study was close conformity with the finding of Babu et al. (2002), Patel et al. (2007) and Patel et al. (2011) in guava. The minimum test weight of 100 seed (1.18g) was recorded hedge row system. The minimum test weight seed followed by (1.38g) in square system. These results are in agreement by Patel et al. (2011), Singh et al. (1980) in guava.

3.4. Bio-chemical parameters

The chemical analysis of the fruit in terms of TSS, reducing sugar (%), non-reducing sugar (%), total sugar (%), acidity (%) (Table 3) revealed that the highest TSS (12.40 °B) was recorded

Table 3: Studies on different planting system cum high density on fruit quality of Guava cv. Sardar (2014-15)

Treat-ments	Length of fruit (cm)	Width of fruit (cm)	Flesh (%)	Seed (%)	Seed index (g)	TSS (°B)	Reducing sugar (%)	Non-reduc-ing sugar (%)	Acidity (%)
T ₁	6.61	6.99	97.89	2.11	1.38	12.40	5.10	7.30	0.38
T ₂	6.55	6.97	98.28	2.72	1.18	11.85	4.90	7.00	0.39
T ₃	6.46	6.96	97.39	2.61	1.29	11.56	4.48	6.98	0.36
T ₄	6.45	6.94	97.67	2.33	1.20	11.80	4.88	6.83	0.30
T ₅	6.46	6.91	97.44	2.56	1.22	12.00	4.65	6.88	0.34
SEm±	0.08	0.06	0.61	0.31	0.10	0.36	0.09	0.11	0.03
CD (p=0.05)	NS	NS	NS	NS	NS	NS	NS	NS	NS

in square system followed by (12.0⁰B) cluster planting system. The minimum (11.56) was recorded in double hedge row system. These findings are in consonance with the findings also reported by Babu et al. (2002), Patel et al. (2011), Singh et al. (1980) and Dhaliwal and Dillon (2003) in guava. The maximum reducing sugar (5.10%) was recorded in square system followed by (4.90%) in hedge row system. Whereas, minimum (4.48%) in double hedge row system. The non-reducing sugar maximum (7.30%) was recorded in square system followed by (7.0%) in hedge row system and lowest (6.83%) in paired planting. The maximum acidity (0.39) was recorded in hedge row system. However minimum (0.30) in paired planting system. These results are in agreement with Babu et al. (2002), Patel et al. (2011) in guava.

4. Conclusion

Double row system is excellent planting system in term of plant height, canopy, higher fruit yield followed by square system in term of higher girth, scion, flesh percentage with less seeds in guava cv. Sardar under Kymore Plateau of Madhya Pradesh region.

5. Acknowledgement

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6. References

- AOAC, 1995. Official methods of analysis. Association of Official Agricultural Chemists, 16thEdn., Washington. D.C.Allahabad Safeda. Haryana Journal of Horticultural Sciences 26 (1-2), 89-91.
- Aulakh, P.S., 2005. Performance of different guava cultivars under the arid irrigated conditions of Punjab. *Progressive Horticulture* 37, 328-330.
- Babu, K.D., Dubey, A.K., Yadav, D.S., 2002. Evaluation of guava cultivars for their performance under mid-hill altitude of Meghalaya. *Indian Journal of Hill Farming* 15, 119-121.
- Bishwas, B., Sen, S.K., Maiti, S.C., 1989. Effect of planting density on growth yield and chemical composition of papaya fruits cv. Ranchi. *Progressive Horticulture* 21(3-4), 280-284.
- Dhaliwal, G.S., Dhillon, S.K., 2003. Effect of Tree size on Physico-chemical characteristics of Fruits of Guava cv. Sardar. *Indian Journal of Horticulture* 60, 312-317.
- Kundu, S., 2007. Effect of high density planting on growth, flowering and fruiting of guava (*Psidium guajava* L.). *Acta Horticulture* 735, 267-270.
- Lal, S., Tiwari, J.P., Maharajan, A.R., 2007. Studies on planting systems in guava (*Psidium guajava* L.) cv. Sardar. *Acta Horticulture* 735, 263-266.
- Lal, S., Tiwari, J.P., Mishra, K.K., 1996. Effect of plant spacing and planting density on flowering and fruiting of guava. *Annal of Agricultural Research* 17, 83-89.
- Lane, J.H., Eynon, L., 1943. Determination of reducing sugar by means of Fehling's solution with methylene blue as an internal indicator. *Journal of Social Chemistry* 42, 327.
- Pandey, D., Shukla, S.K., Yadav, R.C., Nagar, A.K., 2007. Promising guava (*Psidium guajava* L.) cultivars for North Indian condition. In: Singh, G., Kishun, R., Chandra, R.(Eds). *Proceedings of the first International guava Symposium. Acta Horticulture* 735, 91-94.
- Pansee, V.G., Sukhatme, P.V., 1985. *Statistical Methods for Agricultural Workers*. 4th Edn. ICAR, New Delhi.
- Patel, R.K., Maiti, C.S., Deka, B.C., Deshmukh, N.A., Roy, D., 2011. Variability studies in guava (*Psidium guajava* L.) genotypes for growth, yield and quality attribute at mid-hills of Meghalaya. *Indian Journal of Hill Farming* 24(1&2), 24-28.
- Patel, R.K., Yadav, D.S., Babu, K.D., Singh, A., Yadav, R.M., 2007. Growth, yield and quality of various guava (*Psidium guajava* L.) hybrids/cultivars under mid hills of Meghalaya. In: Singh, G., Kishun, R., Chandra, R.(Eds), *Proceedings of the first International guava Symposium. Acta Horticulture* 735, 57-59.
- Reddy, B.M.C. 2004. High density planting in horticultural crops. *First Indian Horticulture Congress*, 6-9 November, New Delhi, 36.
- Singh, G., 2004. Integrated nutrient and water management in relation to high density planting and canopy architecture of mango, guava and aonla: Application of canopy architecture, microirrigation and fertigation in HDP. *Annual Report. NCPAH, DAC, MoA, PFDC, CISH*, pp. 40-47.
- Singh, G. 2005. Meadow orchard system in guava production. *Indian Horticulture*, 17-18.
- Singh, G., 2001. High density planting in guava. *Annual Report, Central Institute of Subtropical Horticulture, Lucknow*.
- Singh, G., 2011. Application of canopy architecture in high density planting in guava. *Progressive Horticulture* 43(1), 36-43.
- Singh, G., Rajan, S., Singh, A.K. 2003. Approaches and strategies for precision farming in guava. In: *Precision Farming in Horticulture*. Singh, H.P., Singh, Gorakh, Samual, J.C. and Pathak, R.K. (eds.), NCPAH, DAC, MoA, PFDC, CISH, 92-113.
- Singh, G., Singh, A.K., Mishra, S., 2007. High density planting in guava. *Acta Horticulture* 735, 235-241.
- Singh, I.S., Singh, H.K., Chauhan, K.S., 1980. Effect of high and low density plantation on yield and quality of guava under semi-arid conditions. *Haryana Agricultural University Journal of Research* 10(3), 421-423.

