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Effect of time of pruning on growth and quality parameters of guava cv. Sardar under different planting densities

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Abstract
An experiment was carried out during *kharif* and *rabi* seasons of 2014 -15 at College of Horticulture, Udyangiri, Bagalkot to study the effect of time of pruning on growth and quality parameters of guava cv. Sardar under different planting densities. The experiment was laid out in split plot design with 6 main treatments as plant spacing and 2 sub treatments as time of pruning with three replications. The data revealed the maximum plant height (1.86m) was observed in closer spacing in M1 and minimum (1.59 m) in wider spacing M6 during rainy season and similar trend was recorded in winter season also. The maximum new shoot length (22cm), shoot girth (5.5mm), number of flowers/shoot (3.14) and fruits/shoot (3.06) was recorded in wider spacing and in quality parameters maximum TSS (9.91 ºB) and Vitamin C in pulp (100.58mg/100g) and in peel (170.58mg/100g) was recorded in wider spacing while acidity was maximum (0.41%) in closer spacing during rainy season and similar trend was observed in winter season also. Among time of pruning and its interaction with spacing were not significant effect on growth and quality parameters.

Keywords: Growth, guava, planting density, pruning time, quality

Introduction
Guava (*Psidium guajava* L.) the "apple of tropics" is a popular fruit tree of tropical and sub tropical climate and is native to the Tropical America stretching from Mexico to Peru. It belongs to the family Myrtaceae. The crop has gained considerable prominence in our country in general and the state of Karnataka in particular because of its high nutritive value, pleasant aroma and availability at moderate price. Besides, it is one of the hardiest among the fruits in productivity, adoptability with nutritional quality and hence it is known as poor man's Apple. Generally guava is cultivated through traditional planting system, in which it is very difficult to achieve desirable level of production. Moreover, in this system guava tree takes five to six years to come to commercial bearing and thus, maximize the overall cost of production per unit area. Therefore high density planting gives early economic production, more return per unit area, provides efficient use of natural resources like land, water and light. Hence, there is overriding need to improve the existing planting system (Singh *et al.* 2000) [4]. There is currently a worldwide trend to plant fruit trees on permanent high density planting orchard and to manipulate tree growth by using canopy management practice to control tree growth patterns and tree shape and maintaining high fruit production of desired size and quality. This is a superior intensive cultivation system and considered as one of the most efficient modern planting systems particularly in respect of productivity of the produce.
Pruning in guava is pre-requisite for the better growth and yield of fruits because it bears on current season growth and flowers appear in the axils of new leaves. Therefore, it responds well to pruning.
Several workers have reported increased yield, fruit size and qualitative attributes of guava as a result of pruning at different periods. This improvement is attributed to better light penetration in to fruit bearing portion of the tree canopy. Determination of the pruning effects on light penetration within guava trees may enable canopy designing for improved fruit yield and quality.

Material and Methods
The experiment was conducted at College of Horticulture, Udyangiri, Bagalkot, which is situated in northern dry zone of Karnataka (Zone-3) located at 16^0 10^0 North latitude, 74^0 42^0

East longitude and at an altitude of 542.0 meters above the mean sea level. The annual rainfall of 543mm, mean temperature of 23.04 ◦C to 28.80 ^{0}C and the relative humidity of 64.16%. The soil of the experimental location was calcareous and P^H 7.60, EC 0.48 ds/m. The experiment was laid out in split plot design with 6 planting densities *viz.* M1 (2x2 m), M2 (3x2 m), M3 (3x3 m), M4 (6x2 m), M5 (6x3 m) and M6 (6x6 m) as a main plot and 2 pruning times, *viz*. S1 (April pruning), S2 (May pruning) as sub plot treatment with three replications. The planting was done during 2011-12 in the experimental field. Observation on growth and quality parameters were recorded. The height of the plants was measured from the ground level to the tip of the main shoot. It was measured at monthly intervals during rainy and winter season and expressed in meters. Number of flowers per shoot was recorded by counting flowers of 5 randomly selected shoots in each of the experimental tree both in rainy and winter season and it was expressed in numbers. Number of fruit per shoot was recorded by counting fruits of 5 randomly selected shoots in each of the experimental tree both in rainy and winter season and it was expressed in numbers. The Total Soluble Solids of juice (TSS) content of the juice was recorded with the help of hand refractometer. It was expressed in degree Brix (ºB). The acidity of the juice was recorded at the time of harvest during both rainy and winter season by titrating 5ml of juice against 0.1 N NaOH, using phenolphthalein as indicator. The acidity was expressed as gram of tartaric acid equivalent in 100 ml of juice (%). Vitamin C was calculated by using bellow formula.

$$\frac{0.5\text{ mg}}{\text{V1 ml}} \text{X} \frac{\text{V2}}{\text{5 ml}} \text{ X } \frac{\text{50 ml}}{\text{Wt. of sample}} \text{X100}$$

Result and Discussion

The growth and fruit quality was significantly influenced by different planting densities while, pruning time and its interaction with spacing did not vary significantly. The data revealed that the maximum plant height (1.86m) was observed in closer spacing in M1 and minimum (1.59 m) in wider spacing M6 during rainy season and similar trend was recorded in winter season also. The tree height was maximum in closer spacing and minimum in wider spacing this might be due to wider spacing canopy spread was more compared to plant height, too close planting tend to increases the plant height because at close planting little space is available for spread of the plant this condition results in more apical growth at the expense of lateral growth. The Similar results were reported by Sidhu *et al*. (1992) [3] in Allahabad Safeda guava. The maximum new shoot length (22cm) and shoot girth (5.5mm) was recorded in wider spacing M6 and minimum was observed in closer spacing this might be due to the competition between plants for light, water and nutrition under closer spacing resulted decreased shoot length and shoot girth.

The data on number of flowers/shoot and fruits/shoot have been presented in Table 2 as significantly influenced by different planting densities while pruning time and its interaction with spacing did not vary significantly. The maximum number of flowers/shoot (3.14) and fruits/shoot (3.06) was recorded in wider spacing and minimum in closer spacing. Maximum number of flowers and fruits/shoot under wider spacing seems to be due to greater photosynthetic activity, because of exposure of more number of leaves to sunlight, that activity of proper sunlight to the lower branches of trees at close spacing becomes a limiting factor and it adversely affects the flowering and fruiting. Similar results were reported by Kumkwat *et al*. (2014)

The maximum TSS (9.91 ºB) and Vitamin C in pulp (100.58mg/100g) and in peel (170.58mg/100g) was recorded in wider spacing while acidity was maximum (0.41%) in closer spacing during rainy season and similar trend was observed in winter season also. At wider spacing TSS was more and acidity was low this might be due the higher photosynthesis and availability of metabolites due to higher interception of photosyntheticaly active radiation by individual tree might have improved fruit quality at wider spacing. Similar results were reported by Mehta *et al.* (2006) [2] and Verma *et al*. (2009) [5].

Table 1: Effect of time of pruning on plant height of guava cv. Sardar under different planting densities during rainy and winter season

Treatment	Plant height(m)					
	Rainy season (June- Oct)			Winter season(Nov - Feb)		
	S1	S2	Mean	S1	S2	Mean
M1	1.87	1.84	1.86	1.98	1.96	1.97
M2	1.79	1.77	1.78	1.88	1.85	1.86
M3	1.72	1.72	1.72	1.80	1.79	1.80
M4	1.68	1.67	1.68	1.76	1.76	1.76
M5	1.64	1.64	1.64	1.73	1.75	1.74
M6	1.60	1.59	1.59	1.67	1.7	1.68
Mean	1.72	1.70	1.71	1.80	1.80	1.80
	S.Em±		CD 5%	S.Em±		CD 5%
M	0.01		0.04	0.02		0.05
S	0.01		NS	0.01		NS
MXS	0.02		NS	0.02		NS

Table 2: Effect of time of pruning on new shoot length and shoot girth of guava cv. Sardar under different planting densities during rainy and winter season

Treatments	New shoot length (cm)						Shoot girth(mm)					
	Rainy season (June- Oct)			Winter season (Nov - Feb)			Rainy season (June- Oct)			Winter season (Nov - Feb)		
	S1	S2	Mean	S1	S2	Mean	S1	S2	Mean	S1	S2	Mean
M1	12.19	12.59	12.39	15.06	15.23	15.15	2.66	2.65	2.65	4.21	4.27	4.24
M2	14.42	14.14	14.28	17.34	16.59	16.96	2.97	3.21	3.09	4.47	4.4	4.46
M3	16.61	16.44	16.52	19.95	19.55	19.75	3.53	3.65	3.59	4.78	4.72	4.70
M4	18.36	18.85	18.60	21.91	22.25	22.08	3.83	3.85	3.84	5.00	4.95	4.97

M5	19.91	20.26	20.08	23.14	23.39	23.25	5.24	4.96	5.10	6.36	6.37	6.36
M6	21.82	22.18	22.00	24.58	25.35	24.96	5.73	5.26	5.50	6.76	6.75	6.76
Mean	17.22	17.41	17.31	20.33	20.39	20.36	3.99	3.93	3.96	5.26	5.25	5.25
	S.Em±		CD5%	S.Em±		CD5%	S.Em±		CD5%	S.Em±		CD5%
M	0.40		1.27	0.54		1.70	0.08		0.26	0.07		0.21
S	0.09		NS	0.09		NS	0.06		NS	0.03		NS
MXS	0.44		NS	0.56		NS	0.14		NS	0.09		NS

Table 3: Effect of time of pruning on flowering and fruiting of guava cv. Sardar under different planting densities during rainy and winter season

Treatments	No. of flowers/shoot						No. of fruits / shoot					
	Rainy season (June- Oct)			Winter season (Nov - Feb)			Rainy season (June- Oct)			Winter season (Nov - Feb)		
	S1	S2	Mean	S1	S2	Mean	S1	S2	Mean	S1	S2	Mean
M1	1.47	1.48	1.47	1.31	1.28	1.3	1.33	1.41	1.37	1.26	1.26	1.26
M2	1.81	1.83	1.82	1.54	1.58	1.56	1.75	1.78	1.76	1.53	1.54	1.53
M3	2.11	2.11	2.11	1.79	1.77	1.78	2.05	2.05	2.05	1.75	1.75	1.75
M4	2.49	2.49	2.495	2.29	2.32	2.30	2.46	2.50	2.48	2.26	2.30	2.28
M5	2.65	2.66	2.66	2.62	2.65	2.63	2.57	2.60	2.59	2.60	2.63	2.62
M6	3.18	3.11	3.14	3.76	3.86	3.81	3.04	3.07	3.06	3.61	3.82	3.72
Mean	2.28	2.28	2.28	2.22	2.24	2.23	2.20	2.23	2.21	2.17	2.22	2.19
	S.Em±		CD at 5%	S.Em±		CD at 5%	S.Em±		CD at5%	S.Em±		CD at5%
M	0.14		0.45	0.05		0.15	0.15		0.48	0.05		0.14
S	0.01		NS	0.01		NS	0.01		NS	0.02		NS
MXS	0.14		NS	0.05		NS	0.15		NS	0.06		NS

Table 4: Effect of time of pruning on fruit quality of guava cv. Sardar under different planting densities during rainy and winter season.

Treatments	TSS (ºB)						Acidity (%)					
	Rainy season (June- Oct)			Winter season (Nov - Feb)			Rainy season (June- Oct)			Winter season (Nov - Feb)		
	S1	S2	Mean	S1	S2	Mean	S1	S2	Mean	S1	S2	Mean
M1	8.90	8.90	8.90	11.00	11.00	11.00	0.39	0.43	0.41	0.31	0.33	0.32
M2	9.05	9.15	9.10	11.23	11.44	11.33	0.37	0.40	0.38	0.30	0.31	0.30
M3	9.30	9.32	9.31	11.36	11.37	11.36	0.34	0.34	0.34	0.27	0.27	0.27
M4	9.52	9.55	9.53	11.92	11.91	11.92	0.31	0.33	0.32	0.25	0.24	0.24
M5	9.70	9.70	9.70	12.09	12.29	12.19	0.30	0.30	0.30	0.24	0.23	0.23
M6	9.92	9.91	9.91	12.30	12.33	12.31	0.28	0.27	0.27	0.22	0.22	0.22
Mean	9.39	9.42	9.40	11.65	11.72	11.68	0.33	0.34	0.35	0.26	0.26	0.26
	S.Em±		CDat 5%	S.Em±		CDat 5%	S.Em±		CDat 5%	S.Em±		CDat 5%
M	0.05		0.15	0.12		0.37	0.01		0.04	0.01		0.03
S	0.03		NS	0.05		NS	0.01		NS	0.01		NS
MXS	0.07		NS	0.15		NS	0.02		NS	0.01		NS

Table 5: Effect of time of pruning on Vitamin C of guava cv. Sardar under different planting densities during rainy and winter season.

Vitamin C(mg/100gm)												
Treatments	Pulp						Peel					
	Rainy season (June- Oct)			Winter season (Nov - Feb)			Rainy season (June- Oct)			Winter season (Nov - Feb)		
	S1	S2	Mean	S1	S2	Mean	S1	S2	Mean	S1	S2	Mean
M1	68.16	68.51	68.34	86.44	85.64	86.04	130.16	130.83	130.49	169.56	169.07	169.31
M2	75.48	75.13	75.30	90.57	90.20	90.38	137.39	137.3	137.34	175.39	175.27	175.33
M3	81.27	81.41	81.34	96.38	96.88	96.63	148.51	148.92	148.72	180.72	180.67	180.70
M4	88.20	88.74	88.47	101.35	102.31	101.83	156.19	156.78	156.49	189.55	189.85	189.70
M5	95.23	95.25	95.24	109.19	110.16	109.68	160.85	160.83	160.84	196.59	196.66	196.62
M6	100.20	100.94	100.58	115.30	115.89	115.59	170.26	170.90	170.58	202.29	203.39	202.84
Mean	84.76	85.00	84.88	99.87	100.18	100.02	150.56	150.93	150.74	185.68	185.82	185.75
	S.Em±		CD at 5%	S.Em±		CD at 5%	S.Em±		CDat 5%	S.Em±		CD at 5%
M	0.22		0.70	0.17		0.55	0.36		1.14	0.19		0.61
S	0.09		NS	0.12		NS	0.13		NS	0.10		NS
MxS	0.27		NS	0.27		NS	0.43		NS	0.26		NS

M1: 2mX2m
M2: 3mX2m
M3: 3mX3m
M4: 6mX2m
M5: 6mX3m
M6: 6mX6m

S1: April pruning
S2: May pruning

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