

Effect of pruning and planting systems on growth, flowering, fruiting and yield of guava cv. Sardar

Pratibha*, Shant Lal and A.K. Goswami**

Department of Horticulture, G.B. Pant University of Agriculture and Technology, Pantnagar 263 145, Uttarakhand

ABSTRACT

In present investigation, the effect of planting systems and pruning on growth, flowering, fruiting and yield of guava cv. Sardar was studied with two pruning levels, *i.e.* one leaf pair pruning and unpruned (control) and five planting systems, *i.e.* square, hedgerow, double-hedgerow, paired and cluster planting. Results revealed that regardless of planting systems, one leaf pair pruning significantly decreased the annual increment in tree height, tree spread, trunk diameter and tree volume as compared to control. Annual increase in tree height (1.63 m) was maximum in double-hedgerow system, while tree spread (1.92 m), trunk diameter (13.3 m) and tree volume (1.80 m³) was maximum in square system of planting with one leaf pair pruning during both the years. Number of flower buds was significantly increased with one leaf pair pruning during winter season crop and maximum number of flower buds (62.2) was found in the treatment combination of one leaf pair pruning and square system of planting. One leaf pair pruning significantly increased the winter season crop as compared to unpruned (control) in all planting systems. In rainy season, the maximum yield (66.0 and 2.77 kg/tree, respectively) was obtained from the treatment combination of unpruned and square system of planting, whereas, in winter season of the same year, maximum yield (62.4 and 2.95 kg/tree, respectively) was obtained from treatment combination of one leaf pair pruning and square system of planting. Thus, it can be concluded that one leaf pair pruning in guava cv. Sardar planted under square system is useful to maximize yield in winter season crop under *terai* regions.

Key words: One leaf pair pruning, planting systems, yield, guava.

INTRODUCTION

The guava is fifth most important fruit crop of India. This fruit is gaining popularity among fruit growers because of its high demands, easy to grow and high productivity (Bal and Dhaliwal, 1). Under *Terai* conditions of Uttarakhand, guava trees flower twice in a year, *i.e.* April-May and July-August and produce about 90 per cent crop in rainy season. The fruits of rainy season crop are rough, insipid, poor in quality and attacked by several insect-pests and pathogens. On the other hand, winter season crop is superior in quality, free from diseases and fetches high price as compared to rainy season crop (Prakash *et al.*, 8). Guava is a pruning responsive crop. Shoot pruning have been reported to be successful in regulating *bahar* in guava. Shoot pruning is also helpful in reducing the tree size and improving the fruit quality and provide opportunity to increase the number of trees per unit area (Lal *et al.*, 4). Similarly, the growth of guava plant is also variable under different planting systems (Lal *et al.*, 5). However, there is a dearth of information on response of guava plants to pruning under different planting systems. Therefore, an experiment was initiated to study the

effect of planting systems and pruning on growth, flowering, fruiting and yield of guava under *terai* region of Uttarakhand.

MATERIALS AND METHODS

The present investigation was carried out at Horticulture Research Centre, Patharchatta of GBPUA&T, Pantnagar during the year 2006-07 and 2007-08. The experimental material consisted of seven-year-old uniform grafted trees of guava cv. Sardar (L-49). The treatment consisted of two pruning levels, *i.e.* unpruned (P_0), one leaf pair pruning (P_1) and five planting systems, *i.e.* square system = S_1 (204 trees/ha), hedgerow system = S_2 (340 trees/ha), double-hedgerow system = S_3 (453 trees/ha), paired system = S_4 (272 trees/ha) and cluster system = S_5 (363 trees/ha) of planting. There were ten treatment combinations each replicated thrice in factorial randomized block design. Shoot pruning of current season's growth was done as per treatment retaining only one leaf pair at the base of the shoot. It was performed in the first week of May every year. Data were recorded for both rainy and winter season on tree height, tree spread, trunk diameter and tree volume was calculated as per the formula given by Westwood *et al.* (10). Number of flower buds per branch, per cent fruit set, per cent fruit drop, number

*Corresponding author's Email: pratibhahorti@rediffmail.com

**Division of Fruits and Horticultural Technology, Indian Agricultural Research Institute, New Delhi

of fruits per tree, yield kg/tree and fruit weight during both the years. The data were statistically analyzed for analysis of variance.

RESULTS AND DISCUSSION

Vegetative growth of guava plants under different planting systems revealed that one leaf pair pruning significantly decreased the tree height, spread, trunk diameter and tree volume as compared to unpruned trees during both the years. Annual increase in height was recorded maximum in the trees planted in double-hedgerow system of planting followed by cluster system of planting and minimum in square system of planting during both the years (Table 1). Increase in plant population per unit area significantly increased the annual increase in tree height and unpruned guava plants under double-hedgerow system of planting gave maximum annual increase in tree height. However, one leaf pruning of guava planted under square system resulted in minimum annual increase in tree height during both the years. It was also evident that with the decrease in plant population per unit area, the annual increase in tree spread, trunk diameter and tree volume was significantly more than denser planting. In the year 2006-07, annual increase in tree spread (1.92 m), trunk diameter (13.3 m) and tree volume (1.80 m³) was recorded in the trees planted in lower plant population, *i.e.* square system of planting and these parameters were recorded minimum in trees planted in higher plant population, *i.e.* double-hedge row system of planting. Similar results were also observed during second year. The treatment combination of unpruned tree and square system of planting gave maximum annual increase in tree spread, trunk diameter and tree volume while, treatment combination of one leaf pair pruning and double-hedgerow system of planting gave minimum annual increase in tree spread, trunk diameter and tree volume during both the year of investigation. It is well established fact that under closer spacing, plant height is increased might be due to competition for light because of insufficient space. The competition between plants for light, water and nutrition under closer spacing resulted less increase in basal girth and crown spread. These results are in agreement with the findings of Pandey *et al.* (7), Prakash *et al.* (8), and Mahajan *et al.* (6).

One leaf pair pruning decreased number of flower bud per branch and fruit set in rainy season and increased significantly during winter season in both the years (Table 2). Trees in square system with lowest plant population per unit area produced significantly higher number of flower buds and fruit set, while minimum number of flower buds and lower fruit set was found in double-hedgerow system of

Table 1. Effect of planting systems and pruning on annual increase in vegetative growth attributes of guava cv. Sardar.

Treatment	Tree height (m)						Tree spread (m)						Trunk diameter (cm)						Tree volume (m ³)							
	2006-07		2007-08		2006-07		2007-08		2006-07		2007-08		2006-07		2007-08		2006-07		2007-08		2006-07		2007-08			
	P ₀	P ₁	Mean	P ₀	P ₁	Mean	P ₀	P ₁	Mean	P ₀	P ₁	Mean	P ₀	P ₁	Mean	P ₀	P ₁	Mean	P ₀	P ₁	Mean	P ₀	P ₁	Mean		
Planting system																										
S ₁	1.0	0.8	0.9	0.95	0.79	0.87	1.98	1.86	1.92	2.04	1.92	1.98	13.9	12.8	13.3	12.4	12.5	12.5	12.5	12.5	2.07	1.52	1.80	2.07	1.53	1.80
S ₂	1.4	1.3	1.33	1.30	1.71	1.51	1.30	1.21	1.25	1.39	1.25	1.32	9.87	9.56	9.71	9.45	9.43	9.44	9.44	9.44	1.25	0.96	1.21	1.31	1.75	1.63
S ₃	1.8	1.8	1.82	1.96	1.75	1.85	1.18	1.11	1.15	1.21	1.15	1.18	9.05	8.98	9.02	9.12	8.88	9.00	9.00	9.00	1.26	1.15	1.11	1.50	1.21	1.53
S ₄	1.5	1.4	1.45	1.45	1.31	1.38	1.57	1.47	1.52	1.79	1.59	1.69	11.9	11.1	11.5	11.2	10.9	11.1	11.1	11.1	1.93	1.58	1.75	2.44	1.47	1.96
S ₅	1.6	1.5	1.58	1.70	1.58	1.64	1.34	1.29	1.31	1.40	1.30	1.35	10.3	10.2	10.3	10.0	10.0	10.0	10.0	10.0	1.50	1.34	1.42	1.75	1.40	1.57
Mean	1.5	1.4	-	1.47	1.40	-	1.47	1.39	-	1.57	1.44	-	11.0	10.5	-	10.4	10.3	-	-	1.60	1.31	-	1.81	1.58	-	
CD at 5%	P = 0.06		0.06		0.06		0.005		0.004		0.004		0.007		0.004		0.004		0.125		0.125		0.130		0.130	
	S = 0.09		0.17		0.17		0.008		0.006		0.006		0.009		0.006		0.006		0.197		0.197		0.157		0.157	
	P×S = 0.21		0.25		0.25		0.118		0.871		0.871		0.169		0.863		0.863		0.450		0.450		0.610		0.610	

P = Pruning, S = Planting system, P × S (I) = Interaction

Table 2. Effect of planting systems and pruning on flowering and fruiting characters of guava.

Treatment	Flower buds per branch						Fruit set (%)																			
	Rainy 2006-07		Winter 2006-07		Rainy 2007-08		Winter 2007-08		Rainy 2006-07		Winter 2007-08		Rainy 2007-08													
	P ₀	P ₁	Mean	P ₀	P ₁	Mean	P ₀	P ₁	Mean	P ₀	P ₁	Mean	P ₀	P ₁	Mean											
Planting system																										
S ₁	70.3	50.4	60.3	19.1	50.9	35.0	68.9	55.4	62.2	17.6	52.6	35.1	60.4	24.5	42.4	29.2	65.6	47.4	61.5	25.3	43.4	32.4	58.1	45.2		
S ₂	58.1	52.7	55.4	11.4	42.3	26.8	56.7	50.5	53.6	11.2	43.7	27.5	48.2	18.6	33.4	25.5	46.6	36.0	50.3	16.2	33.3	22.3	44.4	33.3		
S ₃	43.1	45.6	44.3	7.61	32.1	19.8	41.9	47.4	44.6	9.64	30.1	19.8	37.4	11.6	24.5	18.5	38.4	28.5	35.6	10.3	22.9	16.5	32.1	24.3		
S ₄	64.0	55.6	59.8	15.6	46.4	31.0	61.3	52.5	56.9	14.3	48.2	31.2	54.5	21.3	37.9	27.6	57.4	42.5	55.4	18.4	36.9	26.4	52.5	39.4		
S ₅	56.6	50.7	53.6	10.9	41.9	26.4	53.5	48.3	50.9	11.0	42.4	26.7	49.3	16.3	32.8	17.5	44.5	31.0	48.3	14.7	31.5	22.1	41.5	31.8		
Mean	58.4	51.0	-	12.9	42.7	-	56.4	50.8	-	12.7	43.4	-	50.0	18.5	-	23.6	50.5	-	50.2	17.0	-	23.9	45.7	-		
CD at 5%	P = 2.13				3.85		2.85		2.56		4.05		6.09		3.64		5.14		5.54		2.48		3.92		4.98	
	S = 3.41				6.09		4.51		4.05		5.73		NS		5.14		5.54		5.54		2.48		3.92		4.98	
	I = 4.83				NS		6.38		5.73		5.73		NS		5.14		5.54		5.54		2.48		3.92		4.98	

P = Pruning, S = Planting system, P × S (I) = Interaction

planting with highest plant population per unit area during rainy and winter season in both the years. In both the years, unpruned plants under square system of planting produced maximum number of flower buds per branch in rainy season, while one leaf pair pruning under square system of planting produced maximum number of flower buds per branch during winter season. Furthermore, the maximum fruit set (60.4%) was observed in unpruned guava plants under square system of planting and lowest fruit set (11.6%) was observed in treatment combination of one leaf pair pruning and double-hedgerow system of planting in rainy season. However, in winter season the fruit set was maximum (65.6%) in treatment combination of one leaf pair pruning and square system of planting and minimum (18.5%) in unpruned plants under double-hedgerow system of planting in during both years (Table 2). Early flowering and higher fruit setting in plants under wider spacing seems to be due to greater photosynthetic activity.

Fruit drop increased with the increase in plant population per unit area and maximum was recorded in the trees planted in double-hedgerow system of planting with one leaf pair pruning and lowest fruit drop was recorded in square system of planting with no pruning in rainy and winter seasons during both the years (Table 3). Similarly, less accumulation of carbohydrate reserves and higher sources and sink competition as well as low sunlight harvesting by the plant due to intermingling of branches might be responsible for lower number of flower buds as well as higher in double-hedgerow system. These results are in close conformity with the those of Kumar and Rattanpal (3), Lal *et al.* (4), Mahajan *et al.* (6), and Saxena (9).

In general, number of fruits per tree in pruned trees was lower during rainy season, while it increased significantly during winter season. It was also evident that number of fruits per tree increased with decrease in plant population per unit area during both the years. In first year, maximum number of fruits per tree (487.4) was found in the treatment combination of unpruned tree with square system of planting in rainy season, while it was maximum (397.3) in treatment combination one leaf pair pruning and square system of planting in winter season. In the second year, the similar trend was observed for number of fruits per tree (Table 3). It is evident that pruning significantly affected the yield per tree during both the years. One leaf pair pruning significantly decreased the fruit yield per tree during rainy season and subsequently increased the yield significantly during winter season in both the years. In general, the trees planted in wider spacing gave higher yield per

Table 3. Effect of planting systems and pruning on fruit drop and number of fruits per tree in guava.

Treatment	Fruit drop (%)												No. of fruits per tree												
	Rainy 2006-07				Winter 2006-07				Rainy 2007-08				Winter 2007-08				Rainy 2006-07				Winter 2007-08				
	P ₀	P ₁	Mean	P ₀	P ₁	Mean	P ₀	P ₁	Mean	P ₀	P ₁	Mean	P ₀	P ₁	Mean	P ₀	P ₁	Mean	P ₀	P ₁	Mean	P ₀	P ₁	Mean	
Planting system																									
S ₁	69.28	73.52	71.40	28.88	42.70	35.79	64.37	69.39	66.88	32.14	38.52	35.33	487.4	18.1	252.7	20.5	397.3	208.9	495.3	20.60	257.9	27.6	407.3	217.5	
S ₂	77.68	81.66	79.67	41.64	45.59	43.62	82.54	78.34	80.43	47.39	53.47	50.43	395.3	17.23	206.2	17.49	331.3	174.4	401.1	16.3	208.7	19.7	335.4	177.6	
S ₃	81.72	85.47	83.59	51.53	55.69	53.61	82.54	87.74	85.14	56.17	61.58	68.88	350.4	13.4	181.9	15.4	316.5	166.0	360.2	10.2	185.2	13.4	320.3	166.9	
S ₄	72.40	76.37	74.39	46.00	43.43	44.71	73.50	78.46	75.98	45.53	51.94	48.73	475.1	16.5	245.8	18.4	352.3	123.6	480.4	18.5	249.4	22.5	380.2	201.3	
S ₅	73.82	77.63	75.73	43.70	47.63	45.66	74.44	79.57	77.00	48.75	54.67	51.71	388.4	14.9	201.6	16.3	328.7	172.5	395.4	15.7	205.5	16.3	331.4	173.8	
Mean	74.98	78.93	-	42.35	47.01	-	75.47	78.70	-	45.99	52.04	-	419.3	16.0	-	17.6	345.2	-	426.5	16.3	-	19.9	354.9	-	
CD at 5%	P = 3.12		NS		NS		1.87		NS		NS		2.02		1.88		3.18		3.18		2.20		2.20		
	S = 4.94		8.45		2.95		2.95		4.32		4.32		3.20		2.97		5.04		5.04		3.48		3.48		
	I = NS		NS		NS		NS		NS		NS		4.52		4.21		7.13		7.13		4.93		4.93		

P = Pruning, S = Planting system, P × S (I) = Interaction

tree as compared to trees planted in closer spacing. In rainy season of the two years, the maximum yield (66.0 and 2.77kg/tree, respectively) was obtained from the treatment combination unpruned and square system of planting, whereas, minimum yield (1.53 and 38.7 kg/tree, respectively) was obtained from the treatment combination one leaf pair pruning and double hedgerow system of planting. In winter season of the same year, maximum yield (62.4 and 2.95 kg/ tree) was obtained from treatment combination of one leaf pair pruning and square system of planting and minimum yield (1.84 and 41.3 kg/tree) was obtained from the trees planted in the treatment combination unpruned and double-hedgerow system of planting (Table 4). This might be due to the fact that the photo-synthates during rainy season were diverted for the development of more fruits during winter season (Chandra and Govind, 2). It was also evident that pruning significantly improved fruit weight in rainy as well as winter season of both the years. One leaf pair pruning treatment gave significantly higher mean fruit weight than unpruned trees. However, the planting systems had only significant effect on mean fruit weight in winter season of 2007-08 and fruits obtained from square system of planting had the maximum fruit weight, while double-hedgerow system gave fruits weight, which was at par with hedgerow planting system. These results are in agreement with Saxena (9), and Mahajan *et al.* (6).

In conclusion, double-hedge row system of planting in guava along with one leaf pair of pruning may be adopted to increase yield with insignificant or less reduction in fruit weight and quality.

REFERENCES

- Bal, J.S. and Dhaliwal, G.S. 2003. High density planting studies in guava. *Haryana J. Hort. Sci.* **32**: 19-20.
- Chandra, R. and Govind, S. 1995. Influence of time and intensity of pruning on growth, yield and fruit quality of guava under high density planting. *Trop. Agric.* **72**: 110-13.
- Kumar, Y. and Rattanpal, H.S. 2010. Effect of pruning in guava planted at different spacing under Punjab conditions. *Indian J. Hort.* **67**. 115-19.
- Lal, S., Tiwari, J.P. and Misra, K.K. 2000. Effect of plant spacing and pruning intensity on fruit yield and quality of guava. *Prog. Hort.* **32**: 20-25
- Lal, S., Tiwari, J.P. and Mahajan, A.R. 2007. Studies on planting systems in guava (*Psidium guajava* L.) cv. Sardar. *Acta Hort.* **735**: 263-66.

Table 4. Effect of planting systems and pruning on yield and fruit weight in guava.

Treatment	Av. yield (kg/tree)														
	Rainy 2006-07			Winter 2006-07			Rainy 2007-08			Winter 2007-08					
	P ₀	P ₁	Mean	P ₀	P ₁	Mean	P ₀	P ₁	Mean	P ₀	P ₁	Mean			
Planting system															
S ₁	135.4	152.1	143.7	144.1	157.1	150.6	137.4	150.6	144.0	145.1	159.3	152.2	152.2	139.0	145.1
S ₂	118.9	132.5	125.7	133.4	142.6	138.0	120.3	135.1	127.7	132.8	145.1	139.0	139.0	126.9	132.8
S ₃	110.6	114.1	112.3	118.9	130.6	124.7	112.5	117.9	115.2	122.1	131.3	126.9	126.9	115.8	131.3
S ₄	125.4	143.7	134.5	135.4	152.6	144.0	127.1	144.1	135.6	138.5	153.1	145.8	145.8	132.7	153.1
S ₅	115.5	122.4	118.9	128.5	133.1	130.8	117.4	124.3	120.8	130.0	135.5	132.7	132.7	114.8	135.5
Mean	121.1	132.9	-	132.0	143.2	-	122.8	134.4	-	133.7	144.9	-	144.9	121.5	144.9
CD at 5%	10.35	NS	NS	13.48	NS	NS	13.63	NS	NS	11.29	17.85	NS	17.85	3.06	11.29
	NS	NS	NS	NS	NS	NS	NS	NS	NS	3.99	6.32	3.88	6.32	4.84	3.99
	NS	NS	NS	NS	NS	NS	NS	NS	NS	7.42	7.02	7.22	7.02	7.42	7.22

P = Pruning, S = Planting systems, I = Interaction

6. Mahajan, A.R. 2004. Studies on planting systems in guava (*Psidium guajava* L.). M.Sc. thesis, G.B. Pant University of Agriculture and Technology, Pantnagar, 93 p.
7. Pandey, A., Sharma, A.B. and Patel, M.P. 1997. Effect of planting system cum high density on growth, yield and quality of Sardar guava (*Psidium guajava* L.). *Adv. Pl. Sci.* **10**: 153-56.
8. Prakash, S., Kumar, V., Saroj, P.L. and Sirohi, S.C. 2012. Response of yield and quality of winter guava to severity of summer pruning. *Indian J. Hort.* **69**: 173-76.
9. Saxena, A.R. 2002. Effect of pruning and plant density on the performance of guava (*Psidium guajava* L.). M.Sc. thesis, G.B. Pant University of Agriculture and Technology, Pantnagar, 138 p.
10. Westwood, M.N., Raimer, F.C. and Quakenbush 1963. Long term yield as related to ultimate tree size of three pear varieties grown on rootstock of five *Pyrus* spp. *Proc. American Soc. Hort. Sci.* **82**: 103-8.

Received : July, 2008; Revised : June, 2013;
Accepted : July, 2013