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Effect of Pruning on Growth, Flowering and Yield in High Density Planting of Guava

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ABSTRACT

A field experiment was conducted during 2011-12 to assess the effect time of shoot pruning with different combinations on vegetative growth, flowering and yield attributes in high density planting of guava cv Pant Prabhat. The study of one (year) indicates that half shoot (50%) pruning significantly influenced cropping pattern of guava. Half shoot pruning in April and July have positive effect towards vegetative growth viz., plant height, plant spread, plant volume, emergence of new shoots and similar yield in each rainy and winter season crop. Half shoot pruning in April results in lowered rainy season yield and more number of emergence of new shoots/ plant, flower buds/ plant and increased fruit weight during winter season. Lowest yield (1.40 kg/plant) recorded in unpruned control in winter season.

Key words: *Growth, Pruning, Meadow orchard, Flowering, Guava yield*

INTRODUCTION

Guava trees are hardy, prolific bearer, long lived, drought tolerant and need comparatively less attention which makes its cultivation more remunerative. It is a favoured crop among fruit growers due to its wide adaptability and higher return per unit area. But, of late, this crop has exhibited a paradigm shift in the production system, from subsistence farming to commercial production. Tree spacing is one method used to obtain efficient and profitable land use. Its basic function is to confine the exploitation zone of the plant with regard to light, water, and nutrients so the highest total yield can be reached in the smallest possible area[8]. With ever increasing land costs, and the need for early returns on invested capital, there is a worldwide trend toward high density plantings.

The increasing importance of guava as a commercial tropical fruit crop, both for table purposes and processing, demands its wide spread cultivation by ensuring regular cropping and higher production. Generally, guava is cultivated using traditional planting system, under which it is difficult to achieve desired levels of production, because large trees provide low production/ unit area and need high labour inputs. Hence, there is overriding need to improve the existing planting system.

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Meadow orchard in guava is one of the techniques where higher number of plants/unit area is accommodated compared with the conventional planting density. Under meadow orcharding where fruiting starts with first year, a precise level of pruning is required to make the balance between vegetative and reproductive phase. Keeping in view the present investigation, effect of pruning on growth, flowering and yield attributes in high density planting of guava cv 'Pant Prabhat' was conducted.

MATERIALS AND METHODS

The research was conducted at Horticulture Research Centre, Pattarchatta of G.B. Pant University of Agriculture & Technology, Pantnagar during the year 2011-12. The experimental material consisted of two year old uniform grafted plants of guava (*Psidium guajava* L.) cv Pant Prabhat planted in a single hedge row system. These plants were maintained under uniform cultural schedule throughout the period of experiment. The soil of the orchard is silty clay loam with a pH of 8.0. The soil samples were air dried, crushed to pass a 2-mm screen and analyzed for its properties.

The treatments consists seven different combinations of time of shoot pruning and one control. In this way there were eight treatments replicated four times in Randomised Block Design with two plants as a treatment unit (Table 1). The orchard was planted during October, 2009 under single hedge row system of planting as spacing of 2 m (row to row) x 1 m (plant to plant) accommodating 5000 plants per hectare. The adapted experimental design was a randomized complete block design.

The following observations were taken for both rainy and winter season crop *viz.*, vegetative growth (plant height with the help of measuring scale, plant stem diameter with the help of Vernier calliper, plant volume, plant spread with help of measuring tape, shoot growth with the help of measuring scale), emergence of new shoot per plant, terminal shoot length and lateral shoot length with the help of measuring scale, number of flower buds per plant were recorded in the month of April and July before and after shoot pruning, respectively, fruit set (%), flower/fruit drop (%), fruit retention (%), number of fruits per plant, fruit yield (kg. plant^{-1}) and fruit weight (g.) were recorded with the help of physical balance.

Table 1: The treatment and the symbols allotted as given below:

SI. No.	Treatment	Symbol
1.	T_1 :Half shoot pruning in April	PA
2.	T_2: Half shoot pruning in July	PJ
3.	T_3: Half shoot pruning in October	PO
4.	T_4: Half shoot pruning in April and July	PAJ
5.	T_5: Half shoot pruning in April and October	PAO
6.	T_6: Half shoot pruning in July and October	PJO
7.	T_7: Half shoot pruning in April, July and October	PAJO
8.	T_8: Unpruned (Control)	CUN

The data were statistically analysed for analysis of variance according to Snedecor and Cochran[9].

RESULTS AND DISCUSSION

Plant Growth and Vigour

The data presented in Table 2 revealed that implementation of different treatments influenced the vegetative growth of guava plant in terms of plant height, plant spread, plant stem diameter and plant volume. All the treatments differ significantly in April 2012 and October 2012 but did not differ significantly during July 2012 in case of plant height. However, shoot pruning treatment pruning in April, July and October (T_7) showed same trend for the period of April 2012, July 2012 and October 2012, which was lowest increase in plant height. Plant height (1.67 m) was recorded maximum in the treatment PO and minimum (1.55 m) in treatment PAJO and PAJ, respectively in April 2012. While in July 2012, maximum plant height (2.09 m) was recorded in treatments PJ and minimum (1.80 m) in the treatment PAJ and PAJO. Plant spread did not differ significantly in all the time of pruning *i.e.*, April 2012, July 2012 and October 2012. However, pruning treatments showed similar results for all the time of pruning *i.e.*, April 2012, July 2012 and October 2012, the maximum increase in plant spread was recorded in the treatment (T_8) and minimum in pruning treatment (T_7). The plant spread was recorded maximum (2.07 m) in the treatment unpruned control (T_8) and minimum (1.61 m) spread was recorded in pruning in April, July and October (T_7) during April 2012 and, in July 2012, maximum (2.17 m) in unpruned control (T_8) and minimum (1.62 m) in treatment pruning in April, July and October (T_7), and in October 2012, maximum (2.16 m) in unpruned control (T_8) and minimum (1.74 m) in treatment pruning in April (T_1) and pruning in April, July and October (T_7) . Plant stem diameter did not differ significantly during all the time of pruning. However, pruning treatment (T_7) recorded minimum increase in plant stem diameter for the period of April 2012, July 2012 and October 2012, and maximum increase in April 2012 found with the unpruned control, and for July 2012 and October 2012, it was observed in the treatment pruning in October (T_3). The data for the plant volume did not differ significantly for both the seasons (*i.e.,* April 2012 and July 2012), however, it recorded significant in October 2012. Data presented in the Table 2 clearly indicated that lowest increase in plant volume was observed in the shoot pruning treatment (T_7). The highest (6.90 m^3) and lowest (5.26 m^3) increase in plant volume was recorded in unpruned control (T_8) and pruning in April, July and October (T_7), respectively in April 2012 and the highest (9.08 m^3) and lowest (6.17 m^3) increase in plant volume recorded in treatment pruning in July (T_2) and pruning in April, July and October (T_7), respectively in the month of July 2012, and in October 2012, highest (10.14 m^3) and lowest (6.61 m^3) increase in plant volume was found in the treatment (T_8) and (T_7), respectively. Maximum increase in plant volume in unpruned treatments may be due to more increase in plant height and spread and, minimum increase in plant stem diameter and plant volume with treatments (T_7) because of three times half (50%) shoot pruning in a year. Proper control of vegetative growth is a prerequisite for high-density planting and without it there is overcrowding and shading, which reduces flower-bud formation, fruit retention, fruit size and fruit colour. Control of apical growth must begin within the first year of planting and continue each year in high-density planting (HDP). Since guava is highly responsive to pruning, topping and hedging in different periodicity. Pruning removes carbon-starved, fruiting exhausted shoots and promotes new leaf growth to build up

carbohydrates reserves for the next flowering and allows the sprouting of lateral buds, which ultimately influence the plant height, plant spread, plant volume and other vegetative characters of plants. This is in accordance with the findings of Dhaliwal *et al*[3]., Kumar and Rattanpal[4] and Sah *et al*[7]., in guava.

The data presented in the Table 2 indicated that the emergence of new shoots highly responsive to 50% shoot pruning and it differs significantly in the month of April 2012, July 2012 and October 2012. The emergence of new shoots recorded highest number (370.50) in the treatment pruning in October (T_3) and lowest (278.25) in pruning in July (T_2) in the month of April 2012. The highest number of new shoots emerged (381.37) in pruning in April and July (T_4) followed by the treatment pruning in October (T_3) and lowest number of emergence of shoots (286.25) recorded in the pruning treatment (T_2), in the month of July 2012, and in October 2012, the maximum (328.00) and minimum (164.75) emergence of new shoots was recorded in the treatment (T_1) and (T_5), respectively. The data presented for the shoot length (terminal and lateral) in the Table 2 did not found significant all the time of pruning. However, it was observed that highest increase in terminal shoot length in the pruning treatment (T_6) and lowest in the pruning treatment (T_4) during all the time of observation *i.e.* April 2012, July 2012 and October 2012, respectively. The highest (32.70cm, 33.37cm, and 25.22cm) increase in terminal shoot length and lowest (28.20 cm, 28.41cm and 20.45cm) increase in terminal shoot length was recorded in the treatment pruning in July and October (T_6) and pruning in April and July (T_4), respectively in April 2012, July 2012 and October 2012. The highest (13.42 cm) increase in lateral shoot length and lowest (11.18 cm) increase in lateral shoot length recorded in the treatment pruning in October (T_3) and pruning in April, July and October (T_7), respectively in the month of April 2012 and, in July 2012, highest (13.01 cm) increase in lateral shoot length and lowest (9.24 cm) increase in lateral shoot length was recorded in treatment pruning in July (T_2) and pruning in April, July and October (T_7), respectively and in October 2012, highest (9.55 cm) increase in lateral shoot length and lowest (6.63 cm) increase in lateral shoot length was recorded in treatment pruning in July and October (T_6), and pruning in April and October (T_5), respectively. Chandra and Govind[1], Dalal *et al*[2]., and Sah *et al*[7]., have also reported increased growth in guava.

Flowering and Yield attributes

The data presented in the Table 3 for the number of flower buds per plant show non significant results during both the seasons *i.e.*, rainy and winter season. The maximum (143.87) number of flower buds and minimum (114.50) number of flower buds per plant recorded in unpruned control (T_8) and pruning in April and July (T_4), respectively in rainy season and, in winter season, maximum (87.75) followed by treatment (T_1) number of flower buds and minimum (74.50) number of flower buds per plant was recorded in the treatment PAJO, PA and PJO, respectively. The data presented in the Table 3 revealed that per cent fruit set differs significantly during both the seasons *i.e.* rainy and winter. The per cent fruit set per plant was recorded maximum (68.46%) followed by (67.58%) and minimum (20.86%) in the treatment pruning in July and October (T_6), unpruned control (T_8), and pruning in April and October (T_5), respectively in rainy season and, during winter season, found highest (67.44%) followed by (67.32%) and lowest (36.02%) in treatment pruning in October (T_3), pruning in April (T_1) and

pruning in April, July and October (T_7), respectively (Table 3 and Plate 2). The data presented in the Table 3 revealed that the per cent flower/ fruit drop differed significantly during both the seasons. The per cent flower/ fruit drop was recorded highest (79.13%) and lowest (31.53%) in the treatment pruning in April and October (T_5) and pruning in July and October (T_6), respectively in rainy season and, in winter season, highest (63.97%) and lowest (32.55%) per cent flower/fruit drop was recorded in the treatment pruning in April, July and October (T_7) and pruning in October (T_3), respectively. Data presented in the Table 3 clearly indicated that per cent fruit retention differs significantly during both the season of experiment. However, the per cent fruit retention was recorded highest (80.98%) and lowest (53.23%) in the treatment pruning in April, July and October (T_7) and pruning in October (T_3), respectively in rainy season and, in winter season, highest (86.86%) and lowest (21.90%) per cent fruit retention was recorded in the treatment pruning in April and July (T_4) and unpruned control (T_8), respectively. Though flowering in guava occurs in current season's growth. Therefore, pruning helps in getting new fruiting units thus increases the number of flowers/shoot. Similar results also reported by Dalal *et al*[1]., and Dhaliwal *et al*[3]., they also obtained an increase in fruit set, fruit retention by pruning over control in guava. The number of fruit and fruit yield per plant compared to control was significantly influenced by half shoot pruning in rainy and winter season. However, less fruit number, fruit yield/plant was recorded in winter season crop in unpruned treatments. The highest (55.50) and lowest (20.75) number of fruits per plant recorded in control (T_8) and pruning in April and July (T_4), respectively in rainy season and, in winter season, highest (29.50) and lowest (10.87) number of fruits per plant was recorded in the treatment (T_1) and control (T_8), respectively. The maximum (6.58kg.) followed by (6.39kg.) and minimum (2.74kg.) fruit yield was found in untreated control (T_8), pruning in July (T_2) and pruning in April and July (T_4), respectively in rainy season and, in winter season, maximum (4.09 kg.) followed by (3.80 kg.), and minimum (1.40 kg.) fruit yield was obtained in the treatment pruning in April (T_1) followed by treatment (T_7) and control (T_8), respectively. Data presented in the Table 3 clearly indicated that fruit weight show similar trends for both rainy and winter season. However, fruit weight was recorded maximum (139.00 g.) and minimum (118.71 g.) in the treatment pruning in April, July and October (T_7) and control (T_8), respectively in rainy season and, in winter season, maximum (144.00g.) and minimum (128.46g.) fruit weight was recorded in the treatment pruning in April, July and October (T_7) and control (T_8), respectively. Increase in fruit number and fruit yield/ plant under 50% shoot pruning may be attributed to the proper balance between the vegetative and reproductive growth of the plants. The highest yield from unpruned plant during the rainy season was due to higher percentage of fruit set and least flower/ fruit drop, which ultimately resulted in production of higher yield during rainy season. Since unpruned plant got exhausted because of the heavy crop load during the previous season, they produced less number of flower buds for winter season and subsequently lower yield in winter. These findings are in accordance with Lal *et al*[5]. and Sah *et al*[7]. by 50% shoot pruning. Dhaliwal *et al*[3]., and Chandra and Govind[1] observed significantly higher fruit weight, fruit number/ plant and fruit yield/ plant by 50% shoot pruning in guava during rainy season. Similar findings also reported by Pilanin *et al*[6]., by 50 % shoot pruning in guava.

Table 2: Influence on plant growth dynamics of guava cv Pant Prabhat by different pruning time

Treatment	Plant height (m)			Plant spread (m)			Stem diameter (cm)			Plant volume (m^3)			Emergence of new shoots/ plant			Shoot length (cm)					
																Terminal			Lateral		
	April 2012	July 2012	October 2012	April 2012	July 2012	October 2012	April 2012	July 2012	October 2012	April 2012	July 2012	October 2012	April 2012	July 2012	October 2012	April 2012	July 2012	October 2012	April 2012	July 2012	October 2012
PA	1.57	1.83	2.17	1.66	1.78	1.74	3.23	4.40	5.23	5.47	6.86	7.99	322.62	344.00	328.00	29.32	30.38	21.11	12.72	12.47	9.05
PJ	1.58	2.09	2.08	2.05	2.09	2.09	3.51	4.88	5.57	6.80	9.08	8.96	278.25	286.25	187.50	29.87	30.22	23.96	13.17	13.01	8.71
PO	1.67	1.95	2.37	1.79	1.76	1.79	3.50	5.06	5.72	6.27	7.18	8.82	370.50	379.12	215.12	32.47	32.00	21.52	13.42	11.83	9.05
PAJ	1.55	1.80	1.94	1.68	1.89	2.06	3.19	4.24	4.79	5.47	7.19	8.33	365.37	381.37	179.37	28.20	28.41	20.45	11.81	12.35	7.04
PAO	1.58	1.84	2.08	1.90	1.99	2.15	2.99	4.44	5.29	6.28	7.73	9.41	288.00	309.00	164.75	28.92	29.81	24.27	12.56	11.62	6.63
PJO	1.62	1.93	2.24	1.73	1.93	2.12	3.46	4.55	5.42	5.89	7.86	9.92	363.25	374.50	210.00	32.70	33.37	25.22	11.90	10.33	9.55
PAJO	1.55	1.80	1.80	1.61	1.62	1.74	2.95	4.25	4.78	5.26	6.17	6.61	302.50	327.00	166.12	28.87	29.44	21.78	11.18	9.24	8.79
CUN	1.59	1.97	2.27	2.07	2.17	2.16	3.54	4.82	5.39	6.90	8.94	10.14	320.00	330.62	182.25	31.20	31.99	21.90	12.75	11.62	7.28
CD at 5%	0.05	NS	0.26	NS	NS	NS	NS	NS	NS	NS	NS	1.95	62.21	61.21	57.32	NS	NS	NS	NS	2.17	NS

Table 3: Influence on flowering and yield attributes of guava cv Pant Prabhat by different pruning time

Treatment	Number of flower buds/ plant		Fruit set (%)		Flower/fruit drop (%)		Fruit retention (%)		Yield attributes					
									Number of fruits/ plant		Yield (kg/ plant)		Fruit weight (g.)	
	Rainy	Winter	Rainy	Winter	Rainy	Winter	Rainy	Winter	Rainy	Winter	Rainy	Winter	Rainy	Winter
PA	136.62	84.00	27.86	67.30	72.13	32.69	77.85	51.92	27.62	29.50	3.78	4.09	137.50	140.00
PJ	116.75	78.87	66.56	36.22	33.43	63.77	69.02	41.56	53.50	11.50	6.39	1.50	119.56	131.56
PO	138.50	75.25	66.94	67.44	33.05	32.55	53.25	31.61	49.00	15.75	5.88	2.01	120.24	127.74
PAJ	114.50	78.25	24.87	36.30	75.13	63.70	74.26	86.86	20.75	24.50	2.74	3.36	132.46	137.46
PAO	135.12	82.12	20.86	67.17	79.13	32.82	79.23	47.07	22.25	25.75	3.05	3.62	136.58	141.08
PJO	122.51	74.50	68.46	36.76	31.53	63.23	63.09	45.44	51.50	12.37	6.23	1.62	121.46	130.21
PAJO	118.37	87.75	27.14	36.02	72.86	63.97	80.98	81.29	25.25	26.50	3.48	3.80	139.00	144.00
CUN	143.87	75.75	67.58	66.51	32.41	33.48	58.08	21.90	55.50	10.87	6.58	1.40	118.71	128.46
CD at 5%	NS	NS	10.78	7.45	10.78	7.45	18.48	10.32	6.01	4.36	0.63	0.60	11.57	NS

Unpruned control

Half (50%) shoot pruning

Plate 1. Half shoot pruning in April, July and October

Plate 2. A close view of fruiting twigs as result of half shoot pruning

CONCLUSION

On the basis of present investigation, it can be concluded that cropping pattern, flowering, yield and quality of guava can be influenced by time of half (50%) shoot pruning treatments. For obtaining maximum winter season yield and profit from meadow orchard of guava, half shoot pruning should be done in the last week of April.

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