



Impact of Heading Back and Pinching on Vegetative and Reproductive Parameters of Guava (*Psidium guajava* L.) under High Density Plantation

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ABSTRACT

An investigation to evaluate the effect of heading back and pinching on growth and yield parameters of Guava (*Psidium guajava* L.) under high density plantation was carried out at experimental orchard, Department of Horticulture, CCS Haryana Agricultural University, Hisar during the year 2013-14. There were two treatments i.e. heading back and pinching. Heading back at the level of 150, 175 and 200 cm was done in the month of March and compared with control (no heading back). Pinching i.e. no pinching, one pinching (last week of June), two pinchings (last week of June and July) and three pinchings (last week of June, July and August) were done on the headed back plants. The study revealed that all the treatments were effective in increasing the growth characters, however, heading back at the level of 200 cm and two pinchings were found most effective in increasing the growth characters i.e. number of sprouts per shoot, flowering intensity, fruit setting, number of fruits/plant and yield over control and other treatments. Plant height, plant spread and tree volume were significantly reduced by various heading back treatments, however, the effect of different numbers of pinching was found non significant in altering the plant height, spread and volume.

Key Words: Heading back, Pinching, Growth, Yield, High density plantation, Guava

INTRODUCTION

There is a worldwide trend to plant fruit trees at higher density in order to control tree size and maintain desired architecture for better light interception and ease in operations such as pruning, pest control and harvesting. The high density planting and several other operations are involved in improving the yield and quality of guava fruits. Among them, heading back and pinching were important factors to sustain the yield and quality of fruits in high density planted guava (Sahay and Singh, 2001; Mehta *et al* 2012). There are number of horticultural economic and practical reasons for heading back and pinching in guava to obtain productive and efficient trees and orchards. Some of these are firstly to control tree size and shape and secondly, for renewal of bearing shoots, rejuvenation of older plants especially in high density planting, fruit thinning to improve fruit size, yield and quality. Pinching of current season's growth is an alternative practice used to control vigor.

At present there is little documentation regarding the effect of heading back and pinching on the subsequent tree growth and productivity of guava especially under North Indian conditions. Thus, to gather the requisite information about the aforesaid cultural practice, an investigation to note down the effects of heading back and pinching on vegetative and reproductive characters of guava (*Psidium guajava* L.) under high density plantation was undertaken.

MATERIALS AND METHODS

The study was carried out at experimental orchard, Department of Horticulture, CCS Haryana Agricultural University, Hisar during the year 2013-14. The experiment was laid out in factorial randomized block design allocating four levels of heading back i.e. Control (no heading back), 150, 175 and 200 cm above ground level and four pinchings i.e. no pinching, one pinching in last week of June, two pinchings in last week of

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July and three pinchings in last week of August with three replications, comprising 16 treatment combinations.

Trees taken for the study were uniformly grown six year old, spaced at the distance of 6 m x 2 m. They were kept under uniform condition of orchard management during the study period where all the agronomic practices were carried out as per package of practices. The number of sprouts on each experimental tree were counted on four selected branches one in each direction during second fortnight of April. On each experimental tree the shoot length was recorded from four tagged branches, one in each direction. The average shoot length per branch was calculated and expressed in centimeter (cm). Height of the trees was measured with the help of measuring pole up to the maximum point of height ignoring only the off type shoots and expressed in meters. The distance between points to which most of branches of a tree had grown in the North-South and East-West directions were measured and expressed in meters (m). The tree volume was calculated in (m³) by formula given by Roose *et al* (1986) as $V = 4/6 \pi r^2 h$

where, h= height of tree (m) and
sum of E-W and N-S directions (m)

$$r = \frac{\text{sum of E-W and N-S directions (m)}}{4}$$

E-W= East – West; N-S= North – South

Flowering intensity was measured by fixing a meter cube (quadrat) in the plants and counting the numbers of flowers in the cube. It was expressed as flowers/m³. The per cent fruit set was calculated one month after anthesis from four tagged branches. The average per cent fruit set was calculated by formula given below-

$$\text{Fruit set (\%)} = \frac{\text{Number of fruits set}}{\text{Total flowers counted}} \times 100$$

The number of fruits was counted on four tagged branches and average was worked out. The total fruit yield per tree was calculated by multiplying total number of fruits per plant with the average fruit weight and expressed in kilogramme (kg).

RESULTS AND DISCUSSION

Number of sprouts per shoot

Heading back at 200 cm and 175 cm level significantly increased the number of sprouts per shoot over control (Table 1). Pinching numbers and interaction between heading back levels and pinching numbers were found non-significant in increasing the number of sprouts per shoot. Increase in number of sprouts per shoot by heading back may be due to overcome of apical dominance and supply of more food materials. These results were in line with earlier work carried out by Lakhpathi *et al* (2013). It was reported that pruning intensity at 30 cm increased the number of sprouts per shoot

Table 1. Effect of heading back and pinching on number of sprouts per shoot of guava under high density plantation.

Heading back \ Pinching	Pinching				Mean
	No Pinching	One pinching	Two pinchings	Three pinchings	
Control	2.00	2.20	2.26	2.03	2.12
150 cm	2.36	2.38	2.35	2.25	2.34
175 cm	2.20	2.55	2.67	2.63	2.51
200 cm	2.65	2.40	2.76	2.55	2.59
Mean	2.30	2.38	2.51	2.37	

CD at 5%: Heading back (H) - 0.38, Pinching (P) – NS, H x P - NS

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whereas, Dubey *et al* (2001) in guava reported that 25 per cent pruning intensity produced maximum number of sprouts per shoot as compared to control.

Shoot length

There was marked increment in shoot length per branch of guava hybrid Hisar Safeda due to severe pruning (heading back at 150 cm) and least shoot length was found in control (Table 2). This increase in shoot length may be attributed to the reserve food material in the main scaffolds or branches due to which new growth was put forth just after the heading back. In present study, shoot length decreased with increasing numbers of pinchings. This decrease in shoot length may be due to overcome of apical dominance and emergence of lateral shoots. Shoot length was significantly

affected by the interaction of heading back levels and pinching numbers. Increase in shoot length with increase in pruning level was also reported by Mohammed *et al* (2006) in guava.

Plant height

Plant height decreased significantly with increasing severity of heading back (Table 3). Minimum plant height was found with severe heading back (150 cm) and maximum plant height was recorded with control (no heading back). It might be due to the fact that pruned trees were unable to make up the loss of growth caused by severe pruning in this short period. Numbers of pinchings and its interaction with different levels of heading back were found non significant in altering the plant height of guava. Similar findings

Table 2. Effect of heading back and pinching on shoot length (cm) of guava under high density plantation.

Pinching \ Heading back	No Pinching	One Pinching	Two pinchings	Three pinchings	Mean
Control	25.80	23.10	21.20	20.80	22.73
150 cm	49.40	45.20	42.30	41.20	44.53
175 cm	48.10	40.10	38.00	36.20	40.60
200 cm	36.30	30.70	32.90	27.50	31.85
Mean	39.90	34.78	33.60	31.43	

CD at 5%: Heading back (H) - 0.68, Pinching (P) - 0.68, H x P - 1.37

Table 3. Effect of heading back and pinching on plant height (m) of guava under high density plantation.

Pinching \ Heading back	No Pinching	One Pinching	Two pinchings	Three pinchings	Mean
Control	5.47	5.33	5.27	5.24	5.33
150 cm	3.18	2.95	3.00	2.95	3.02
175 cm	3.73	3.63	3.60	3.37	3.58
200 cm	3.73	3.83	3.83	3.68	3.77
Mean	4.03	3.94	3.93	3.81	

CD at 5%: Heading back (H) - 0.14, Pinching (P) - NS, H x P - NS

Table 4. Effect of heading back and pinching on plant spread (m) of guava under high density plantation

Heading back \ Pinching	No Pinching	One Pinching	Two pinchings	Three pinchings	Mean
Control	5.58	5.45	5.32	5.30	5.41
150 cm	3.70	3.40	3.43	3.55	3.52
175 cm	4.05	4.10	4.22	4.14	4.13
200 cm	4.42	4.51	4.45	4.34	4.43
Mean	4.44	4.37	4.35	4.33	

CD at 5%: Heading back (H) - 0.26, Pinching (P) – NS, H x P - NS

were obtained in guava cv. Sardar by 30 cm pruning level by Rajwant and Dhaliwal (2001). Kumar and Rattanpal (2010) also reported similar results in guava by removal of half the vegetative growth. The present investigation was also in consonance with the findings of Singh *et al* (2012) and Prathiba *et al* (2013) in guava.

Plant spread

There was marked reduction in plant spread of guava cultivar Hisar Safeda due to severe heading back at 150 cm (Table 4). In present study, pinching numbers and interaction of different levels of heading back and pinching numbers had non significant effect on plant spread. The reduction in plant spread with increasing severity of heading back might be attributed by the fact that pruned trees were unable to make up the loss of growth caused

by severe pruning in this short period. Likewise, in mango, Lal and Mishra (2008) reported greater canopy spread in unpruned trees than in pruned trees. Similar findings were observed by Kumar and Rattanpal (2010), Singh *et al* (2012) and Prathiba *et al* (2013) in guava.

Tree volume

With severe heading back, there was significant reduction in tree volume (Table 5). The fact that pruned trees was unable to make up the loss of growth caused by severe pruning in this short period. Pinching numbers and interaction of heading back levels and pinching numbers were found non significant in altering trees volume of guava. Similar results were observed by Kumar and Rattanpal (2010) where they found maximum tree volume (118.8 m³) in control trees and was

Table 5. Effect of heading back and pinching on tree volume (m³) of guava under high density plantation.

Heading back \ Pinching	No Pinching	One Pinching	Two Pinchings	Three Pinchings	Mean
Control	89.81	86.55	79.15	75.87	82.84
150 cm	33.01	29.64	28.53	28.15	29.83
175 cm	42.19	42.36	40.64	44.15	42.34
200 cm	48.93	51.54	51.29	50.01	50.44
Mean	53.48	52.52	49.90	49.55	

CD at 5%: Heading back (H) - 6.56, Pinching (P) – NS, H x P - NS

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minimum (57.1 m³) under pruning treatment by removal of half vegetative growth in guava. Singh *et al* (2012) showed that pruning decreased the tree canopy volume in guava.

Flowering and fruiting characters

It is appropriate to mention here that after heading back of guava plants in March 2014, there was no flowering up to one year i.e. following rainy and winter season except in control plants because the plants entered into juvenile phase. Hence, the discussion given below is for rainy season crop of 2015.

Flowering intensity

Flowering intensity was found significantly higher in plants headed back at 200 cm in comparison to control because less current season wood was available due to no pruning in control plants (Table 6). Similarly, the pinching numbers also had a significant effect on flowering intensity in comparison to control. Trees pinched twice (June and July) produced maximum number of flowers, whereas, minimum flowering intensity was recorded in trees which were not pinched. The interaction between heading back and numbers of pinching was also found significant. The increase in flowering intensity with pinching as compared to the unpinched trees indicates that pinching resulted in production of new growing points on the pinched trees. The trend of results of the present study was

similar to Mohammed *et al* (2006) who reported that maximum flowering intensity was recorded in 60 cm pruning treatment in guava. However, these results of present study were in contradiction with the earlier findings of Jadhav *et al* (2002) who showed that number of flowers per shoot on severely pruned (60%) trees of guava were more than mild pruned (30 %) trees and control.

Fruit setting

Per cent fruit set was significantly increased with decreasing severity of heading back (Table 7). Maximum fruit set was recorded with trees headed back at 200 cm level and minimum in control. The increase in fruit set with pruning as compared to the unpruned trees indicates that pruning resulted in production of new growing points on the pruned trees. Further, it also reduced flower drop, thus directly increase the number of fruits per tree and resulted in higher fruit set. Numbers of pinchings also significantly affected the fruit set in guava. Highest fruit set was recorded in plants pinched two times (June and July). This increase in fruit set may be attributed to the fact that pinching produces lateral shoots which in turn gives new growing points. Dhaliwal and Singh (2004) and Brar *et al* (2007) also reported higher fruit set in pruned trees of guava. However, the results are contrary to the findings of Dubey *et al* (2001) who found, maximum fruit set in control and minimum with 100 per cent pruning intensity in guava.

Table 6. Effect of heading back and pinching on flowering intensity (flowers/m³) of guava under high density plantation

Pinching \ Heading back	No Pinching	One Pinching	Two Pinchings	Three Pinchings	Mean
Control	58.0	62.3	68.0	64.7	63.3
150 cm	72.3	77.0	83.3	83.0	78.9
175 cm	90.7	94.0	103.0	99.3	96.8
200 cm	98.0	105.3	110.0	108.7	105.5
Mean	79.8	84.7	91.1	88.9	

CD at 5%: Heading back (H) - 0.93, Pinching (P) - 0.93, H x P - 1.86

Table 7. Effect of heading back and pinching on fruit setting (%) of guava under high density plantation.

Pinching \ Heading back	No Pinching	One Pinching	Two pinchings	Three Pinchings	Mean
Control	76.8	77.8	77.9	77.9	77.6
150 cm	80.8	81.5	85.5	81.8	82.4
175 cm	84.8	85.3	85.5	85.9	85.4
200 cm	88.6	88.7	90.7	89.2	89.3
Mean	82.8	83.3	84.9	83.7	

CD at 5%: Heading back (H) - 1.2, Pinching (P) - 1.2, H x P - NS

Number of fruits per plant

There was marked increment in number of fruits per plant with decreasing severity of heading back where 200 cm heading back level increased the fruits significantly in comparison to other heading back levels and control (Table 8). The increment in fruit number may be attributed to the increment in the bearing shoot on the tree due to heading back and pinching. In respect to pinching numbers, trees pinched twice (June and July) produced maximum number of fruits. Number of fruits per plant was found significant with the interaction effect of different heading back levels and numbers of pinching. In unpinched plants number of fruits per plant is less due to shading effect of close planting. Similar observations were reported by Mohammed *et al* (2006) and Brar *et al* (2007) in guava.

Fruit yield

Yield was affected significantly by all the heading back levels as well as by pinching numbers (Table 9). Regarding level of heading back, plants headed back at 200 cm level registered the highest yield. In case of pinching numbers, trees pinched twice (June and July) gave maximum yield. The better effect of heading back on the yield per plant may be ascribed to production of shoots conducive to flowering and fruiting. The yield in severe heading back was lower due to reduced number of fruits. In unpinched plants yield is poor due to shading effect of close planting. A similar observation was also reported by Sahay and Singh (2001) and Mehta *et al* (2012) in guava.

Table 8. Effect of heading back and pinching on number of fruits per plant of guava under high density plantation.

Pinching \ Heading back	No Pinching	One Pinching	Two pinchings	Three pinchings	Mean
Control	146.0	153.0	156.3	155.2	152.6
150 cm	163.7	173.3	190.3	189.4	179.2
175 cm	178.3	188.3	194.0	190.3	187.8
200 cm	194.3	197.3	212.3	208.1	203.0
Mean	170.6	178.0	188.3	185.8	

CD at 5%: Heading back (H) - 3.54, Pinching (P) - 3.54, H x P - 7.09

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Table 9. Effect of heading back and pinching on fruit yield (kg/tree) of guava under high density plantation.

Pinching Heading back	No Pinching	One Pinching	Two pinchings	Three pinchings	Mean
Control	12.89	14.07	15.86	14.88	14.43
150 cm	13.79	15.26	15.99	15.87	15.23
175 cm	14.55	15.80	16.50	16.54	15.85
200 cm	17.77	19.09	22.16	21.03	20.01
Mean	14.75	16.06	17.63	17.08	

CD at 5%: Heading back (H) - 0.65, Pinching (P) – 65, H x P - NS

CONCLUSION

From the experimental results it can be inferred that heading back and pinching in guava under high density plantation in north-western Indian conditions is effective in improving growth, yield and yield attributes. Heading back at the level of 200 cm and two pinchings were found most effective in increasing the parameters particularly number of sprouts per plant, flowering intensity, fruit setting, number of fruits per plant and finally the yield over other treatments. These intercultural operations might have helped in controlling and managing the excessive growth and vigour of the plant which ultimately helped in enhancing the productivity of the crop.

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