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EFFECT OF HEADING BACK ON GROWTH, FRUITING AND QUALITY CHARACTERISTICS OF REJUVENATING GUAVA PLANTS

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ABSTRACT

The present investigation entitled "Effect of Heading Back Height on Growth, Fruiting and Quality Parameters of Rejuvenating Guava Plants" was conducted on more than 25 years old plants of L-49 cultivar in one-way classification with three replications during June 2018 to Sept., 2019 at Kushal Bagh Farm, Rajasthan College of Agriculture, Maharana Pratap University of Agriculture and Technology, Udaipur. In this experiment three level of heading back height i.e.1.0, 1.5 & 2.0 m, with three levels of pruning intensity *i.e.* 25, 50 & 75% pruning of shoots and their nine treatment combination were evaluated. The result revealed that T5 (*i.e.* heading back at 1.5-meter height + 50% pruning of shoots) exhibited the highest number of sprout per plant (69.67), after 3 months of heading back length of shoot (44.00 cm) at 60 days after pruning (DAP), respectively with maximum number of fruits per plant 54.33), breadth of fruit (6.31 cm), weight of fruit (113.10 g), fruit yield per plant (6.11 kg), specific gravity of fruit (0.86 g/cc) and TSS (13.57 °B). Therefore, among various treatments used in present study, the treatment T_5 (*i.e.* heading back at 1.5-meter height + 50% pruning of shoots) was found to be significantly effective for improved growth, fruit yield and quality of rejuvenated guava plants.
Keywords **:** Heading Back, Rejuvenating, Fruiting, Guava and Quality.

Introduction

Guava (*Psidium guajava* L.) belong to family Myrtaceae, is the fifth most important fruit crop of India. It is a delicious and nutritious fruit, rich in vitamin C (200-300 mg 100 g^{-1} of pulp), calcium, mineral and phosphorus. During 2017-18, the production of horticulture crops was about 311.7 million tons from an area of 25.4 million hectares in India. Among them guava cover 276 thousand hectare area with production of 4236 thousand MT (Anonymous, 2019). Guava is one of the most important highly productive fruit crops and grown commercially throughout subtropical and tropical regions of the world. Uttar Pradesh, Bihar, Rajasthan, Madhya Pradesh and Maharashtra are the major guava growing states in the country.

Guava is a climacteric fruit. Guava fruits are used as fresh fruit as well as making jam, jelly, paste, toffees and candy etc. Guava fruits, leaves and roots are used for curing diarrhea, dysentery and other traditional medicines (Patel *et al.,* 2015). Guava is available in cheap rate and popularly known as 'apple of plains' and 'poor man's apple'.Guava bears on current season's growth and flowers appear in axils of leaves, therefore, it responds well to pruning. There are three distinct flowering seasons in guava namely, spring (Ambe bahar), rainy (Mrig bahar) and autumn (Hastha bahar) with corresponding harvesting period in rainy, winter and spring, respectively.

Topping and heading back generally increased the number of new shoots (Singh, 2007). Rejuvenated guava plants bear more number of flowers and give more yields as compared to fresh plantation in first year just after rejuvenation of orchard but, after that yield is decline year after year (Baloda *et al.,* 2018). The productivity of guava is quite less than its productive potential. One of the reasons for the low

productivity is a large number of old guava orchards in the age group of 15-20 years and above, have either gone unproductive or showing marked decline in productivity. This is attributed to over-crowded and intermingling of large branches and meager foliage, allowing poor light availability to growing shoots within the canopy (Singh *et al.,* 2005). Guava is a pruning responsive crop because of current season's bearing habit and restores the balance between the roots and shoot system and also maintain growth and vigour of shoots by allowing fewer growing points to grow vigorously (Saini *et al.,* 2016).

Pruning increases fruit yield and physio-chemical character of mature fruits. Pruning also maximizes the gross income of orchard (Mehta *et al.,* 2012). Total yield during winter season increased significantly in May to June pruned trees than the unpruned trees. Pruning at different severity affects the fruit yield and length of new shoots as compare to unpruned trees. Moderate pruning gives highest yield but shoots length is more in severely pruned trees (Shaban and Haseeb, 2009). Pruning in May and June gave the highest ascorbic acid content in guava fruits (Singh and Singh, 2001). Pruning of guava trees is highly desirable to maintain their vigour and productivity as well as to improve fruit size. Studies have reported that the time and level of pruning influence growth, flowering and yield of guava.

Materials and Methods

The present investigation entitled "Effect of Heading Back Height on Growth, Fruiting and Quality Parameters of Rejuvenating Guava Plants" was conducted on more than 25 years old plants of L-49 cultivar in one-way classification with three replications during June 2018 to Sept., 2019 at Kushal Bagh Farm, Rajasthan College of Agriculture, Maharana Pratap University of Agriculture and Technology, Udaipur. In this experiment three level of heading back height i.e.1.0, 1.5 & 2.0 m, with three levels of pruning intensity i.e. 25, 50 & 75% pruning of shoots, and their nine treatment combination were evaluated. The observations were recorded during trial period. In case of vegetative growth parameters; number of sprout was observed after 3 months of heading back of plants while, the length of shoots, diameter of shoots was recorded after 30 & 60 days of pruning of plants. The fruit yield and quality parameter was also observed during the investigations. The statistical analysis of the data for the experiment was done as per the standard procedure laid down by Fisher (1954). The details of experimental plan are as follows (Table 1 and Table 2):

Table 1: Details of experiments of Guava

1.	Crop	Guava (*Psidium guajava* L.) var. L-49
2.	No. of Replications	3
3.	No. of Treatments	9
4.	Experimental design	ONE WAY CLASSIFICATION (Factorial CRD)
5.	Experimental location	Kushal Bagh, Rajasthan College of Agriculture,Udaipur, Rajasthan
6.	Age of plants	>25 years old

Table 2 : Treatment combinations of experiment

Treatment No.	Treatment Details	Notation
T1	Heading back at 1.0 meter height + 25% pruning of shoots	H1P1
T2	Heading back at 1.0 meter height + 50% pruning of shoots	H1P2
T3	Heading back at 1.0 meter height + 75% pruning of shoots	H1P3
T4	Heading back at 1.5 meter height + 25% pruning of shoots	H2P1
T5	Heading back at 1.5 meter height + 50% pruning of shoots	H2P2
T6	Heading back at 1.5 meter height + 75% pruning of shoots	H2P3
T7	Heading back at 2.0 meter height + 25% pruning of shoots	H3P1
T8	Heading back at 2.0 meter height + 50% pruning of shoots	H3P2
T9	Heading back at 2.0 meter height + 75% pruning of shoots	H3P3

Results and Discussion

Effect of heading back height (H) on growth parameters

It is evident from the data of heading back height treatment had significant effect on all vegetative growth parameters of guava. It was observed that H_2 treatment *i.e.*1.5 m heading back height has resulted in significantly maximum number of sprouts (63.78), after 3 month of heading back and the highest length of shoot (7.22 & 42.67 cm) and diameter of shoot (5.33 & 8.33 cm) at 30 and 60 days after pruning, respectively

(Table 3 and 4). Increase in number of sprouts per shoot by heading back might be due to removal of apical dominance, supply of more food materials, release of buds from correlative inhibition and efficient transfer system. This might also be attributed to relatively more nutrient available to vegetative bud and also may be due to more light interception that induces early sprouting of vegetative buds. Further, this increase in shoot length may be attributed to relatively less numbers of shoots and therefore, more nutrients available to each shoot on these trees under identical condition and the reserve food material in the main scaffolds or branches due to which new growth was put forth just after the heading back. The maximum diameter of shoot could be attributed to vigorous growth of shoot, which might have resulted to increased diameter of shoot. Similar observation was also reported by Singh *et al.* (2012) in pear & Saini *et al.* (2016) in guava.

Effect of heading back height (H) on fruit parameters

The heading back height treatment significantly influenced the fruit parameter *viz.* number of fruits per plant, length of fruits, breadth of fruits, weight of fruits, fruit yield per plant, volume of fruits and specific gravity of fruits in guava. The H_2 treatment *i.e.* heading back at (H_2) 1.5 m height gave significantly the highest values for number of fruits per plant (47.89), length of fruits (4.94 cm), breadth of fruits (6.14 cm), weight of fruits (111.07 gm), fruit yield per plant (5.31 kg), volume of fruits (100.11 cc) and specific gravity of fruits (0.84 g/cc) in comparison to other levels heading back heights. There was marked increment observed in all fruit parameters with decreasing height of heading back. The data showed that there was significant difference was noticed with regards to weight of fruit, diameter of fruit and volume of fruit due to the effect of heading back height. This might be attributed to the reduction in crop load on severely pruned tree which resulted in the diversion of more translocates to the remaining fruits thereby increased the fruit size and weight and similar results also reported by Brar *et al.* (2007) in guava. The increment in number of fruits per plant may be attributed to the increment in the bearing shoot on the tree due to heading back. The better effect of heading back on the yield per plant because of optimum balance between the vegetative and reproductive growth of trees and production of shoots conducive to flowering and fruiting. The yield in severe heading back was lower due to reduced number of fruits. The increment in length of fruits and breadth of fruits in rejuvenated trees might be due to lesser competition between developing fruits and increased vegetative growth resulting higher availability of photosynthates to the fruits. Similar observation was also reported by Mehta *et al*. (2012) in guava.

Effect of heading back height (H) on quality parameters

The different treatments had significant effect on quality parameters of headed back guava. Among various heading back treatments, H_2 (1.5 m) significantly increased TSS, ascorbic acid, acidity, reducing sugar, total sugar and pectin as compared to other heading back treatments. However, the heading back height at 1.0 m (H_1) and heading back height at 2.0 m (H_3) recorded at par results in respects of TSS, ascorbic acid, acidity, reducing sugar, total sugar and pectin. The data showed that, maximum TSS (12.94 °B) was observed with H2 treatment i.e. heading back at 1.5 m height, which was significantly superior over the rest of treatments. The higher TSS in fruits could be obviously due to the better availability of carbohydrates reserved stored in pruned shoots. Therefore, increased rate of photosynthesis due to more light penetration into interior tree canopy increased the soluble solids in fruits of pruned trees. The results are similar with the finding of Singh and Dhaliwal (2004). Maximum ascorbic acid (187.00 mg/100 g pulp) content in H_2 treatment (1.5 m) could be attributed to the prevalence of good temperature receives at the time of fruit ripening which not only retarded the excessive loss of respiratory substances but also increased the translocation of photosynthates from leaves to the fruits. These result consonances with the findings of Lal *et al*. (2000) in mango. The decrease in acidity was in accordance with the earlier findings. This could be attributed to deposition of higher quantum of acid that is synthesized in leaves and fruits during their development. Enhancement in reducing and total sugar might be due to increase nutrient uptake by the trees and consequently more synthesis of carbohydrates and other metabolites and their translocation to the fruits. It was also due to the fact that in rejuvenated plants, controlled canopy with more effective sunlight penetration and vigorous plant growth eventually resulted in deposition of more sugar in fruits. The carbohydrate metabolism might be hastened with proper dry matter partitioning from source to sinks. These results are in conformity with the findings of Basu et al. (2007) and Kumar and Rattanpal (2010) in guava.

Conclusion

Based on one-year experimentation it may be concluded that heading back height and pruning intensity treatment brought an additive effect in increasing growth, yield and quality of guava. The highest fruit yield of guava with higher quality was obtained with T_5 treatment (*i.e.* heading back at 1.5 m height + 50% pruning of shoots) (H_2P_2). Thus, for guava plants the heading back height at 1.5 m + 50% pruning of shoots were found most suitable treatment. These results are only indicative and require further experimentation to derive credible conclusion.

Table 3: Effect of heading back height, pruning intensity and their interaction on different parameters of Growth, Fruiting and Quality of Rejuvenating Guava Plants

Treatments	Number of sprouts per plant (after 3 months of heading back)	Length of shoot (cm)		Diameter of shoot (cm)		No. of fruit per plant	Length of fruit (cm)	Breadth of fruit (cm)	Weight of fruit (gm)	Fruit yield per plant (kg)	Volume of fruit (cc)
		30 DAP	60 DAP	30 DAP	60 DAP						
Heading back height (H)											
H1 (1.0 m)	19.00	3.44	22.22	2.33	5.11	29.11	4.26	5.20	100.33	2.94	87.22
H2 (1.5 m)	63.78	7.22	42.67	5.33	8.33	47.89	4.94	6.14	111.07	5.31	100.11
H3 (2.0 m)	38.89	5.22	34.89	4.33	6.33	35.78	4.24	5.62	107.39	3.84	94.76
SEm±	**0.748**	**0.192**	**0.454**	**0.16**	**0.19**	**0.41**	**0.04**	**0.03**	**0.23**	**0.05**	**0.97**
CD @ 5%	**2.223**	**0.572**	**1.348**	**0.47**	**0.57**	**1.21**	**0.11**	**0.10**	**0.68**	**0.14**	**2.87**
Pruning intensity (P)											
P1 (25%)	34.22	4.56	29.89	3.67	6.22	33.56	4.22	5.45	104.64	3.54	91.89
P2 (50%)	47.78	5.89	36.22	4.33	7.00	41.44	4.76	5.80	107.46	4.50	96.02
P3 (75%)	39.67	5.44	33.67	4.00	6.56	37.78	4.47	5.70	106.69	4.06	94.18
SEm±	**1.296**	**0.192**	**0.454**	**0.16**	**0.19**	**0.41**	**0.04**	**0.03**	**0.23**	**0.05**	**0.97**
CD @ 5%	**3.850**	**0.572**	**1.348**	**0.47**	**0.57**	**1.21**	**0.11**	**0.10**	**0.68**	**0.14**	**2.87**
Interaction (HxP)											
T1 (H1P1)	15.00	2.33	17.00	2.00	4.67	26.00	4.00	5.02	98.50	2.56	85.20
T2 (H1P2)	23.33	4.33	26.67	2.67	5.67	31.67	4.50	5.36	100.63	3.22	89.80
T3 (H1P3)	18.67	3.67	23.00	2.33	5.00	29.67	4.27	5.20	101.87	3.03	86.67
T4 (H2P1)	58.00	6.67	41.00	5.00	8.00	41.33	4.63	5.81	109.27	4.51	97.67
T5 (H2P2)	69.67	7.67	44.00	5.67	8.67	54.33	5.27	6.31	113.10	6.11	102.00
T6 (H2P3)	63.67	7.33	43.00	5.33	8.33	48.00	4.93	6.29	110.83	5.32	100.67
T7 (H3P1)	29.67	4.67	31.67	4.00	6.00	33.33	4.03	5.52	106.17	3.54	92.80
T8 (H3P2)	50.33	5.67	38.00	4.67	6.67	38.33	4.50	5.72	108.63	4.16	96.27
T9 (H3P3)	36.67	5.33	35.00	4.33	6.33	35.67	4.20	5.62	107.37	3.83	95.20
SEm±	**1.296**	**0.333**	**0.786**	**0.27**	**0.33**	**0.70**	**0.06**	**0.06**	**0.39**	**0.08**	**1.67**
CD @ 5%	**3.85**	**NS**	**2.33**	**NS**	**NS**	**2.08**	**NS**	**0.17**	**1.08**	**0.24**	**NS**

NS = Non-significant

Table 4: Effect of heading back height, pruning intensity and their interaction on different parameters of Growth, Fruiting and Quality of Rejuvenating Guava Plants

Treatments	Specific gravity of fruit (g/cc)	Seed & pulp ratio	TSS (^{O}B)	Acidity (%)	Ascorbic acid (mg/100 g pulp)	Reducing sugar (%)	Total sugar (%)	Pectin (%)
Heading back height (H)								
H1 (1.0 m)	0.81	0.026	11.39	0.46	172.00	5.65	10.19	0.58
H2 (1.5 m)	0.84	0.027	12.94	0.45	187.00	6.99	11.36	0.79
H3 (2.0 m)	0.81	0.026	11.50	0.45	178.67	6.41	10.64	0.67
SEm±	**0.00**	**0.00**	**0.11**	**0.00**	**0.37**	**0.04**	**0.02**	**0.01**
CD @ 5%	**0.01**	**NS**	**0.33**	**0.01**	**1.09**	**0.12**	**0.05**	**0.02**
Pruning intensity (P)								
P1 (25%)	0.81	0.026	11.64	0.46	177.11	6.14	10.54	0.64
P2 (50%)	0.83	0.026	12.35	0.45	181.56	6.58	10.90	0.72
P3 (75%)	0.82	0.025	11.83	0.45	179.00	6.32	10.75	0.68
SEm±	**0.00**	**0.00**	**0.11**	**0.00**	**0.37**	**0.04**	**0.02**	**0.01**

CD @ 5%	**0.01**	**NS**	**0.33**	**0.01**	**1.09**	**0.12**	**0.05**	**0.02**
Interaction (HxP)								
T1 (H1P1)	0.80	0.024	10.71	0.44	170.33	5.45	9.96	0.56
T2 (H1P2)	0.81	0.025	11.89	0.45	173.67	5.81	10.37	0.61
T3 (H1P3)	0.82	0.024	11.56	0.45	172.00	5.69	10.23	0.59
T4 (H2P1)	0.85	0.026	12.59	0.45	185.00	6.74	11.20	0.73
T5 (H2P2)	0.86	0.028	13.57	0.48	189.33	7.34	11.51	0.83
T6 (H2P3)	0.84	0.027	12.65	0.46	186.67	6.88	11.38	0.79
T7 (H3P1)	0.83	0.024	12.18	0.44	176.00	6.22	10.46	0.63
T8 (H3P2)	0.80	0.026	11.60	0.46	181.67	6.59	10.83	0.71
T9 (H3P3)	0.81	0.025	10.71	0.45	178.33	6.40	10.62	0.66
SEm±	**0.01**	**0.001**	**0.20**	**0.01**	**0.64**	**0.07**	**0.03**	**0.01**
CD @ 5%	**0.02**	**NS**	**0.58**	**NS**	**NS**	**NS**	**NS**	**NS**

NS = Non-significant

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