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Performance of different levels of pruning on yield and quality of Guava (*Psidium guajava* L.) Var. Sardar

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Abstract
The present investigation entitled "Effect of different levels of pruning on growth, yield and quality of guava (*Psidium guajava* L.) Var. Sardar was undertaken on eight year old guava plants at the Instructional-Cum-Research Farm, Department of Horticulture, College of Agriculture, Latur during 2012-13. The experiment was laid out in Randomised Block Design with seven treatments replicated thrice. The treatments comprises retention of main trunk upto 1 m along with primary branches 1 m and secondary branches 0.50 m. (T_1), retention of main trunk upto 1 m along with primary branches 1 m and secondary branches 1 m. (T_2), heading back of tertiary branches at 25% (T_3), heading back of tertiary branches at 33% (T_4), heading back of tertiary branches at 50% (T_5), heading back of tertiary branches at 75% (T_6) and control (T_7).
The results of the present study indicated significant differences with respect toquality parameters like maximum fruit weight, diameter of fruit, volume of fruit, TSS, ascorbic acid content, reducing sugars and sugar: acidity ratio were recorded in the treatment of (T_1) retention of main trunk upto 1m along with primary branches 1 m and secondary branches 0.50m. and the treatment (T_2) retention of main trunk upto 1 m along with primary branches 1m and secondary branches 1 m. While maximum no. of shoots per plant, minimum days required for flowering, minimum days required from pruning to fruit set, days from fruit set to harvesting, maximum no. of fruits per tree and maximum yield were recorded in 50%, 33%, and 25% heading back of tertiary branches.
Pruning practice in guava with heading back of tertiary branches at 50%, 33% and 25% are beneficial for obtaining maximum yield and quality fruits.

Keywords: Pruning, yield, quality, Guava, *Psidium guajava* L. Var. Sardar

Introduction
Guava (*Psidium guajava* L.) belongs to family Myrtaceae is one of the most important fruit crops in India which is also known as "Apple of the tropics". The guava is classified under genus *Psidium* that contains 150 species but only *Psidium guajava* is exploited commercially. The common guava is diploid (2n=22), but natural and artificial triploid (2n=33) and anuploid exists (Menzel, 1985). Triploid generally produce seedless fruits (Jaiswal and Amin, 1992). However, most of them are shy bearer.
Guava is rich source of pectin, vitamin C and a fair source of vitamin A, Calcium, Phosphorus, Pantothenic acid, riboflavin, thiamin and niacin. According to Phadnis (1970), guava contains 82.50 percent water, 2.45 percent acid, 4.45 percent reducing sugar, 5.25 percent non reducing sugar, 9.73 ^{0}Brix T.S.S. and 260 mg vit. C per 100 g of fruit. It contains much iron, but 80 percent of this is in the seed, and not utilizable. Guava fruits are best for making jelly it can also be canned in sugar syrup or made into fruit butter. Fruit juice is used for preparation of *sherbets* and ice-creams. The wood is used for small timber and leaves for dye and tannin. The leaves have also medicinal value for curing diarrhea.
Guava is one of the fourth most important fruit crop in India after Mango, Banana and Citrus. In India, it occupies nearly 2.15 lakh hectares of area with production of 32.24 lakh metric tonnes, with average productivity of 14.93 metric tonnes per hectare. The most important guava growing states in India are Uttar Pradesh, Bihar, Maharashtra, Gujarat, Madhya Pradesh, Andhra Pradesh, Tamil Nadu, Rajasthan, Karnataka, West Bengal, Orissa, Kerala and Punjab. In Maharashtra, it is cultivated in the area of 0.33 lakh hectares with production of 2.58 lakh metric tonnes and with an average productivity of 7.71 metric tonnes per hectare. In Maharashtra, Ahmednagar, Satara, Beed, Pune, Aurangabad, Amravati, Buldhana and Bhandara are the principle guava areas.

Pruning refers to removal of parts of tree specially shoots, roots, limbs, buds or nipping away of terminal parts. It is done to make a tree more productive and bear quality fruits. Some fruit trees bear on current season shoots while others do so on the past season growth.

Yield and quality of guava fruits is significantly influenced by pruning. Very scanty research work of pruning for Sardar guava is available under Maharashtra conditions. Hence in a view of above, an experiment of "Effect of different levels of pruning on growth, yield and quality of guava (*psidium guajava* L.) Cv. Sardar" was undertaken with following objective.

Methods and Materials –

The details of the experimental material used, methods followed and techniques adopted during the course of investigation entitled "Effect of different levels of pruning on growth, yield and quality of guava (*Psidium guajava* L.) Cv. Sardar" is given in this chapter with appropriate headings.

Experimental details

A) Experimental material

The experiment was conducted at Instructional-cum-Research Farm, Department of Horticulture, College of Agriculture, Latur on well-establishedeight years old orchard of guava planted at 6.0 X 6.0 m. Total fourty two plants were selected for study.

B) Treatment details

T_1: Retention of main trunk up to 1m along with primary branches 1m and secondary branches 0.50 m.

T_2: Retention of main trunk up to 1m along with primary branches 1 m and secondary branches 1m.

T_3: Heading back of tertiary branches at (25%) portion.

T_4: Heading back of tertiary branches at (33%) portion.

T_5: Heading back of tertiary branches at (50%) portion.

T_6: Heading back of tertiary branches at (75%) portion.

T_7: Control.

Observation details

The observations like number of fruits per plant, average weight of fruit, volume of fruit, yield (kg/plant), yield (MT/ha), weight of seed per fruit, TSS, acidity, ascorbic acid, total sugar, reducing sugar, non-reducing sugar, were recorded on randomly selected fruits. The average values of each trait were worked out from the data of these fruits, which were then subjected to statistical analysis. The details of the observation procedures adopted for each character are as under.

Result and discussion

Yield parameters

The data regarding number of fruits per tree, yield per tree and yield per hectare was presented in Table. the pertaining data showed that there were significant differences with regards to number of fruits per tree, yield per tree and yield per hectare due to different levels of pruning.

Number of fruits per tree

The results presented in Table 1. the significantly maximum number of fruits per tree (340.50) was recorded in the treatment (T_5) heading back of tertiary branches at 50% and it was statistically at par with the treatments T_4 (324.83) and T_3 (323.33) and significantly different over rest of the treatments. However, the minimum number of fruits per tree (150.17) was recorded in the treatment (T_1) retention of main trunk up to 1 m along with primary branches 1 m and secondary branches 0.50 m and which was at par with T_2 (159.50). The minimum number of fruits in the treatment T_1 could be due to the reduction of leaf area which also reduced the net photosynthesis and at the same time reserve food was utilized by the tree for the recovery of pruned foliage to rebuild the balance between tree parts, in guava the flowers and fruits are born on current season growth, a light annual pruning is necessary to encourage new shoots after harvest. Pruning also reduces tree crown area and improves number of fruits and fruit quality. The results of present investigation are confirmity with the findings of Dalal *et al.* (2000) [3] and Brar *et al.* (2007) [2].

Table 1: Effects of different levels of pruning on number of fruits/tree, yield kg /plant and yield MT/Ha.

Treatments	Treatment details	Number of fruits/tree	Yield/plant (kg)	Yield/ha (MT)
T_1	Retention of main trunk up to 1 m along with primary branches 1 m and secondary branches 0.50 m	150.17	37.75	10.45
T_2	Retention of main trunk up to 1 m along with primary branches 1 m and secondary branches 1 m	159.50	39.70	10.60
T_3	Heading back of tertiary branches at 25%	323.33	62.61	17.34
T_4	Heading back of tertiary branches at 33%	324.83	63.13	17.50
T_5	Heading back of tertiary branches at 50%	340.50	64.49	17.86
T_6	Heading back of tertiary branches at 75%	289.33	62.29	17.25
T_7	Control	301.33	51.78	14.34
	S.E ±	10.02	1.45	0.39
	C.D at 5%	30.87	4.49	1.28

Yield per tree

Maximum yield (64.49 kg) was recorded in the treatment (T_5) heading back of tertiary branches at 50% and which was at par with the treatment T_4 (63.13 kg), T_3 (62.61 kg), and T_6 (62.29 kg) and significantly superior over other treatments. While, the minimum yield (37.75 kg) was recorded in treatment (T_1) retention of main trunk up to 1 m along with primary branches 1 m and secondary branches 0.50 m. which was at par with T_2 (39.70kg), presented in Table 4. The fruit yield showed declined in severity of pruning from 75% heading back, this decline in the yield may be ascribed to the reduction in the bearing area due to the severity of pruning. Though the bearing area was maximum in the control treatment yet the yield obtained maximum in heading back of 50% shoots owing to more number of blind shoots in the control trees relative to the trees which received pruning andflowers and fruits are born on current season growth, a light annual pruning is necessary to encourage new shoots after harvest it helps in increase the yield of tree. The results of present investigation are in confirmity with the finding of

Singh and Chauhan (1998) [7] and Singh and Dhaliwal (2004) [9].

Yield per hectare

The data presented in Table 1 and shown that the highest yield per hectare (17.86MT) was recorded in treatment (T_5) heading back of tertiary branches at 50% and it was statistically at par with the treatments T_4 (17.50 MT), T_3 (17.34 MT) and T_6 (17.25 MT) and significantly maximum than other treatments. Whereas, the minimum yield per hectare (10.45MT) was observed in treatment (T_1) retention of main trunk up to 1 m along with primary branches 1 m and secondary branches 0.50 m and statistically at par with T_2 (10.60 MT). The yield per hectare observed maximum in T_5 because of optimum balance between the vegetative and reproductive growth of trees, and maximum number of fruits increase the yield per hectare in T_5. In guava the flowers and fruits are born on current season growth, a light annual pruning is necessary to encourage new shoots after harvest. Pruning also reduces tree crown area and increase number of fruits. The results are finding with the Mohammed *et al.* (2005) [6] and Kumar and Rattanpal (2010) [4].

Quality parameters

Physical attributes

The data in relation to different physical quality aspects of fruits like weight of fruit, diameter of fruit, volume of fruit and weight of seed per fruit are presented in Table 2

The data showed that there were significant differences with regards to weight of fruit, diameter of fruit, volume of fruit and weight of seed per fruit due to the effect of different levels of pruning. This may 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 increase the fruit size and weight and similar results also reported by, Chandra and Govind (1995) and Brar *et al.* (2007) [2]. As regards the weight of seed per fruit the significant maximum weight of seed (3.92 g) was recorded in the treatment (T_1) retention of main trunk upto 1 m along with primary branches 1m and secondary branches 0.50 m. While, minimum weight of seed observed in control (T_7). This maximum seed in T_1 may be due to the fact that the micro climate of tree canopy with pruning was more favorable for pollen germination on stigma or pollen tube penetration through the style. The results are confirmed with the finding of Teaotia and Singh (1976). Who studied the effect of training in Allahabad Safeda.

Table 2: Effect of different levels of pruning on physical quality parameters of guava fruits.

Treatments	Treatment details	Average weight of fruit (g)	Average diameter of fruit (cm)	Volume of fruit (cm^3)	Weight of seed/fruit (g)
T_1	Retention of main trunk up to 1 m along with primary branches 1 m and secondary branches 0.50 m	251.67	7.97	226.40	3.92
T_2	Retention of main trunk up to 1 m along with primary branches 1 m and secondary branches 1 m	245.67	7.92	224.33	3.83
T_3	Heading back of tertiary branches at 25%	205.67	6.53	133.00	3.52
T_4	Heading back of tertiary branches at 33%	208.33	6.45	133.07	3.45
T_5	Heading back of tertiary branches at 50%	200.00	6.17	138.67	3.15
T_6	Heading back of tertiary branches at 75%	220.67	7.24	151.63	3.72
T_7	Control	172.17	6.08	128.00	3.42
	S.E ±	03.26	0.05	2.91	0.05
	C.D at 5%	10.06	0.15	8.96	0.16

Weight of fruit

The data clearly showed that (Table 2) the treatment (T_1) retention of main trunk up to 1 m along with primary branches 1 m and secondary branches 0.50 m recorded the maximum fruit weight (251.67 g) and it was statistically at par with T_2 (245.67 g) and significantly superior over rest of the treatments. However, the significantly lowest weight of fruit (172.17 g) was recorded in control (T_7).

Diameter of fruit

The result revealed that the maximum diameter of the fruit (7.97 cm) was recorded in the treatment (T_1)retention of main trunk up to 1 m along with primary branches 1 m and secondary branches 0.50 m which was statistically at par with the treatment T_2 (7.92 cm) and significantly different from the rest of the treatments. The minimum diameter of fruit (6.08cm) was recorded in control (T_7) and it is at par with T_5 (6.17 cm) and significantly minimum over rest of treatments and presented in Table 2.

Volume of fruit

It was clear from the data (Table 2) that, the maximum volume of fruit (226.40 cm^3) was observed in the treatment (T_1) retention of main trunk up to 1 m along with primary branches 1 m and secondary branches 0.50 m which was statistically at par with treatment T_2 (224.33 cm^3) and significantly higher than the rest of treatments. However, the minimum volume of fruit (128.00 cm^3) was recorded in control (T_7) which was statistically at par with the treatment T_4 (133.07 cm^3), and T_3 (133.00 cm^3).

Weight of seed per fruit

The data in Table 2 indicated that, the maximum weight of seed 3.92 g) per fruit was observed in treatment (T_1) retention of main trunk up to 1 m along with primary branches 1 m and secondary branches 0.50 m and it was statistically at par with the treatment T_2 (3.83 g) and significantly maximum over rest of treatments. While, the lowest weight of seed per fruit (3.42 g) was recorded in the treatment control (T_7) and which was at par with treatments T_5 (3.51 g), T_4 (3.45 g) and T_3 (3.52 g) and significantly different than rest of treatments.

Biochemical attributes

The data pertaining to TSS, acidity, ascorbic acid and sugar: acidity ratio are presented in Table 3 and reducing sugar, non-reducing sugar and total sugars are presented in Table 3. It is evident from the data that, the different biochemical parameters studied were significantly influenced due to different levels of pruning.

Total Soluble Solids

The data in Table 3, showed that, maximum TSS (12.35^0B) was observed in the treatment (T_1) retention of main trunk up to 1 m along with primary branches one meter and secondary branches 0.50 m, which was statistically at par with T_2 (12.32^0B) and significantly superior over the rest of treatments Whereas, the significantly minimum TSS (10.24^0B) was observed in control (T_7). The higher TSS in fruits of pruning trees, as pruning intensity increase the TSS will maximum, it could be obviously due to the better availability of carbohydrates reserved stored in pruned shoots. The results are similar with the finding of Singh and Dhaliwal (2004) [9] and Mohmmed *et al.* (2005) [6].

Table 3: Effect of different levels of pruning on chemical quality attributes of guava fruits.

Treatments	Treatment details	TSS (^{0}B)	Acidity (%)	Ascorbic acid (mg/100g)	Sugar : Acidity ratio
T_1	Retention of main trunk up to 1 m along with primary branches 1 m and secondary branches 0.50 m	12.35	0.472	296.38	18.51
T_2	Retention of main trunk up to 1 m along with primary branches 1 m and secondary branches 1 m	12.32	0.471	296.21	18.40
T_3	Heading back of tertiary branches at 25%	11.30	0.489	293.84	14.98
T_4	Heading back of tertiary branches at 33%	11.25	0.490	294.56	14.84
T_5	Heading back of tertiary branches at 50%	11.19	0.482	294.29	15.02
T_6	Heading back of tertiary branches at 75%	11.91	0.481	295.67	17.01
T_7	Control	10.24	0.493	292.90	13.26
	S.E ±	0.05	0.001	0.38	0.10
	C.D at 5%	0.16	0.004	1.19	0.30

Acidity

The data showed that, the minimum acidity (0.471%) was recorded in the treatment (T_2) retention of main trunk up to 1m along with primary branches 1m and secondary branches 1 m and it was statistically at par with the treatment (T_1) retention of main trunk up to 1m along with primary branches 1m and secondary branches 0.50 m (0.472%) and significantly lowest than other treatments. While, the maximum acidity was recorded (0.493%) in treatment control (T_7) and statistically at par with T_4 (0.490) presented in Table 3.The higher TSS in fruits of pruning trees, as pruning intensity increase the TSS will maximum, it could be obviously due to the better availability of carbohydrates reserved stored in pruned shoots. The results are similar with the finding of Singh and Dhaliwal (2004) [9] and Mohmmed *et al.* (2005) [6].

Ascorbic acid

The data pertaining to ascorbic acid was presented in Table 3. the maximum ascorbic acid content (296.380 mg/100 g) was recorded in the treatment (T_1)retention of main trunk up to 1m along with primary 1m and secondary 0.50 m, which was statistically at par with T_2 (296.21 mg/100 g) and T_6 (295.67 mg/100 g) and significantly higher than the rest of treatments. However, the minimum ascorbic acid content (292.90 mg/100 g) was observed in treatment control (T_7) and at par with the treatment T_3 (293.84 mg/100 g). This could be attributed to the prevalence of low 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 consonance with the findings of Lal *et al.* (2000) [5] and Singh (2011) [8].

Sugar: Acidity ratio

The data in Table 3 indicated that the maximum Sugar : Acidity ratio (18.51) was found in the treatment (T_1) retention of main trunk up to 1m along with primary 1m and secondary branches 0.50 m and it was statistically at par with T_2 (18.40) and significantly higher than rest of the other treatments. While, significantly minimum Sugar: Acidity ratio (13.26) was recorded in control (T_7). The increase or decrease in this index was primarily because of Cviation in these two indices response to pruning.

Reducing sugar

The maximum reducing sugar (5.31%) was recorded in the treatment (T_1) retention of main trunk up to 1m along with primary branches 1m and secondary branches 0.50 m which was statistically at par with the treatment T_2 (5.28%),T_5 (5.20%), T_6 (5.25%) and significantly higher than the rest of the treatments. While minimum reducing sugar content (5.120%) was observed in (T_4) and statistically at par with T_3 (5.170%) presented in Table 4.

Table 4: Effects of different levels of pruning on reducing sugar (%), non-reducing sugar (%) and total sugar (%).

Treatments	Treatment details	Reducing sugar (%)	Non- reducing sugar (%)	Total sugar (%)
T_1	Retention of main trunk up to 1 m along with primary branches 1 m and secondary branches 0.50 m	5.31	3.43	8.74
T_2	Retention of main trunk up to 1 m along with primary branches 1 m and secondary branches 1 m	5.28	3.38	8.66
T_3	Heading back of tertiary branches at 25%	5.17	2.33	7.33
T_4	Heading back of tertiary branches at 33%	5.12	2.15	7.27
T_5	Heading back of tertiary branches at 50%	5.20	2.04	7.24
T_6	Heading back of tertiary branches at 75%	5.25	2.92	8.17
T_7	Control	5.14	1.39	6.54
	S.E ±	0.03	0.09	0.05
	C.D at 5%	0.10	0.26	0.14

Non-reducing sugar

The data in respect of non-reducing sugar was presented in Table 4. The maximum non-reducing sugar (3.43%) was recorded in the treatment (T_1) retention of main trunk up to 1m along with primary branches 1m and secondary branches 0.50 m which was statistically at par with the treatment T_2 (3.38) and significantly different than rest of other treatments. while significantly minimum non-reducing sugar (1.39%) was found in control (T_7).

Total sugars

The data in Table 4 revealed that the maximum total sugars (8.74%) was recorded in the treatment (T_1) retention of main trunk up to 1m along with primary branches 1m and secondary branches 0.50 m which was statistically at par with T_2 (8.66%) and significantly superior over other treatments. Whereas, the significantly minimum total sugar (6.54%) was recorded in control (T_7). This 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. These results are conformity with the findings of Basu *et al.* 2007 and Kumar and Rattanpal (2010) [1, 4].

Conclusion

The different levels of pruning showed positive response on physical as well as biochemical quality parameters of guava fruits. On the basis of overall results obtained, it can be concluded that the heading back of tertiary branches at 50% was found effective for obtaining maximum yield with fairly good quality fruits.

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