Effect of pruning on yield attributes in guava cv. Allahabad Safeda

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Abstract

The failure to manipulate the production periods is a common problem for guava production in India. As a possible management to overcome it the present investigation was conducted in the guava orchard of Department of Horticulture, Khalsa College, Amritsar during the year 2019 to study the effect of pruning intensity and time on yield and quality of winter guava cv Allahabad Safeda. Different pruning levels and time of pruning viz., pruning 10 cm,20 cm and 30 cm of apical shoots during 30th April, 15 May, 30 May and 15 June comprised the treatment combinations. The experiment was laid out in Factorial Randomized Block Design. The results of the study revealed that among the various pruning treatments the pruning of 30 cm of apical shoots on 15 May proved to be the best in increasing the yield and yield attributes in terms of number of fruits per tree and also fruit size, weight and yield. It also improved the fruit quality by increasing TSS, sugars, ascorbic acid and pectin content of guava fruits. Hence the pruning of 30 cm of apical shoots during mid May can be recommended for commercial fruit production with enhanced yield and good quality in guava cv. Allahabad Safeda.

Key words: Apical shoots, Pruning, Pruning intensity, Pectin, Quality, Yield attributes

Introduction

Guava (*Psidium guajava* L.) is the most important commercial fruit crop grown in tropical and sub-tropical region of the Indian subcontinent and is known as apple of tropics [1]. It occupies an important place in the horticultural wealth of our nation [2]. It belongs to family Myrtaceae and is indigenous to tropical America stretching from Mexico to Peru. Guava is an ideal fruit crop for nutritional security in India. It possess a high nutritive value as it is a good source of carbohydrates, minerals, iron, calcium and phosphorous. It is rich in dietary vitamin C with moderate levels of folic acid. Having a generally low calorie profile of essential nutrients a single common guava fruit contains four times the amount of vitamin C [3]. It is also a rich source of vitamin A, riboflavin (B_2) thiamine (B_1) calcium, fair source of phosphorus and a good source of iron. It also contains antioxidant pigments, carotenoids and polyphenols giving them relatively high dietary antioxidant value among the foods [4]. Guava bears on current season's growth and therefore responds well to pruning. Flowers appear in solitary or in cymes of two or three in the axils of leaves. In humid and high rainfall areas crop regulation of guava by using chemicals and growth regulators such as Urea, NAA, etc. are not much more effective because the plant does not go into dormancy due to abundant rainfall received in this area which starts from the month of March. Therefore, pruning could prove to be the most effective method for eliminating rainy season crop and production of winter season guava which is superior in quality free from diseases and fetches high price as compared to rainy season crop [5]. Pruning is defined as the art and science of cutting away a portion of the plant to improve the shape, vegetative growth, flowering, fruitfulness and to improve the quality of the product. It also leads to rejuvenation, better ventilation and higher penetration of sunlight and also become feasible in application of plant protection chemicals. Several workers have reported an increased yield, fruit size and qualitative attributes of guava as a result of pruning at different time intervals thus improvement is attributed to better light penetration into fruit bearing portions of the tree canopy. There is over riding need to manipulate the tree growth using canopy management to maintain high production of desired size and quality guava fruits [6]. It will be highly beneficial to farmers for getting higher yield levels and in maintenance of superior quality of guava[7]. However, organized work in these lines has not been carried out and hence the present investigation was there of undertaken to study the influence of pruning intensity and time on yield and quality of guava cv. Allahabad Safeda.

Materials and Methods

The present investigation was carried out during 2018-2019 on 8 year old guava orchard of cv. Allahabad Safeda planted at a spacing of 6m x 6m at Department of Horticulture, Khalsa College Amritsar. The experiment was laid out in 2-factor Factorial Randomized Block Design with 12 treatment combinations with four pruning intervals (30th April, 15th May, 30th May and 15th June) and three pruning intensities (10 cm, 20 cm and 30 cm of shoot length from the tip) replicated thrice with two plants in each replication. The treatment details are as follows:

- ***Factor -1 (Pruning time)***
  M_1 = 30th April pruning
  M_2 = 15th May pruning
  M_3 = 30th May pruning
  M_4 = 15th May pruning
- ***Factor – 2 (Pruning intensity)***
  P_1 = Pruning of 10 cm of shoot length from the tip
  P_2 = Pruning of 20 cm of shoot length from the tip
  P_3 = Pruning of 30 cm of shoot length from the tip

Treatment combinations

$T_1 = M_1 P_1$ − Pruning of 10 cm of shoot length from the tip on 30th April
$T_2 = M_1 P_2$ − Pruning of 20 cm of shoot length from the tip on 30th April
$T_3 = M_1 P_3$− Pruning of 30 cm of shoot length from the tip on 30th April
$T_4 = M_2 P_1$ − Pruning of 10 cm of shoot length from the tip on 15th May
$T_5 = M_2 P_2$ − Pruning of 20 cm of shoot length from the tip on 15th May
$T_6 = M_2 P_3$ − Pruning of 30 cm of shoot length from the tip on15th May
$T_7 = M_3 P_1$ − Pruning of 10 cm of shoot length from the tip on 30th May
$T_8 = M_3 P_2$ − Pruning of 20 cm of shoot length from the tip on 30th May
$T_9 = M_3 P_3$ − Pruning of 30 cm of shoot length from the tip on 30th May
$T_{10} = M_4 P_1$ − Pruning of 10 cm of shoot length from the tip on 15th June
$T_{11} = M_4 P_2$ − Pruning of 20 cm of shoot length from the tip on 15th June
$T_{12} = M_4 P_3$ − Pruning of 30 cm of shoot length from the tip on 15th June

The plants were pruned with the help of secateurs and pruning saw followed by complete defoliation manually. The cut ends were smeared with a paste of Copper oxychloride in vegetable oil (crude palm oil).The plant protection and other cultural operations were uniformly given as and when required. Various observations regarding flowering, fruiting, yield and biochemical traits were recorded at regular intervals throughout the whole study.

Number of flowers per plant

The number of flowers on each tree was counted manually and the average of six trees under treatment were taken and expressed in number.

Fruit set (%)

Ten branches from each tree were selected randomly in all four directions and at the centre of canopy, then tagged and their flower during bloom were counted and recorded. After the fruit have set, their fruitlets were counted and fruit set (%) was calculated on basis of the initial number of flowers as

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

Number of fruits per plant

The total number of fruits on each tree was counted manually and the average of the trees were taken and expressed in number.

Fruit yield (kg/tree)

The total number of fruits picked per plant were counted and weighed. The yield (kg/tree) was calculated on the basis of product of average fruit weight and the total number of fruits per tree.

Results and Discussion

Number of flowers per tree

According to the results the effect of time of pruning on the number of set flowers per tree was found to be significant. The maximum mean number of flower per tree (268.44) was recorded in M_1 (Pruning of 30th April). The minimum flowering (232.80) was recorded in M_3 (Pruning of 30th May)guava trees. Pruning intensity showed non significant results with respect to flowers per tree. The interaction between the two factors also showed significant influence over the number of flowers. The maximum number of flowers 288.30 was obtained in M_1 P_2(Pruning at 20 cm done on 30th April) while the minimum(220.53) flowers were produced in M_3 P_1. The number of flowers are more in early pruning as compared to late pruning. This might be due to the higher number of flowers in early pruning. Since flowering in guava occurs on current season's growth, pruning helps in getting new fruiting units and thus increase the number of flowers per shoot. Similar findings have been observed by [8] and [9] in guava. [10] also reported the same in guava cv.L-49.

Table 1 : Effect of pruning on number of flowers per tree in guava cv. Allahabad Safeda

Time of Pruning	Level of Pruning (P_1)	(P_2)	(P_3)	Mean M
M_1	282.30	288.30	234.70	268.40
M_2	236.50	231.60	263.90	244.00
M_3	220.53	231.03	247.03	232.80
M_4	240.60	233.30	248.00	240.60
Mean P	244.90	246.00	248.40	

	FPLSD (p=0.05)
Effect of Time of Pruning (M)	22.3
Effect of Level of Pruning (P)	ns
Interaction (MXP)	38.63
CD	9.3

Number of fruits per plant

The perusal of the data indicated that the highest number of fruits per plant (204.70) was recorded in M_1 (30th April pruning) which was followed by (191.30) in M_2 (Mid May pruning). Pruning intensity also showed significant results with respect to number of fruits per plant. The maximum number of fruits per plant (175.50) was recorded in P_1 (pruning at 10 cm of the shoot length).The interaction between the two factors also showed significant influence over the number of fruits per plant. The maximum number of fruits (220.30) was obtained in M_1 P_2(pruning at 20 cm of the shoot pruning on 30th April) and least (168.30) in M_4 P_3 pruning at 30 cm pruning intensity on Mid June. The number of fruit is more in early pruning as compared to late pruning. This might be due to the higher fruit setting in early pruning. Parallel results were stated by [11]. With increasing the pruning severity decrease in fruit yield was observed. The decrease in number of fruit per plant was consequence of pruning which reduced the fruiting area and on the other hand promoted the vegetative growth

at the expense of reproductive growth. [12]. These results are also in line with the findings of [13], Singh [15] ,[10],[6],[15] and[16] in guava fruits.

Table 2 : Effect of pruning on number of fruits per tree in guava cv. Allahabad Safeda

Time of Pruning	Level of Pruning			
	(P_1)	**(P_2)**	**(P_3)**	**Mean M**
M_1	212.00	220.30	181.80	204.70
M_2	191.16	195.60	187.10	191.30
M_3	181.10	175.30	172.23	176.25
M_4	175.50	172.10	168.30	172.00
Mean P		190.80	177.30	

	FPLSD (p=0.05)
Effect of Time of Pruning (M)	4.98
Effect of Level of Pruning (P)	4.31
Interaction (MXP)	8.63
CD	2.75

Fruit set (%)

The data on fruit set per cent depicts that the maximum fruit set(79.03%) was recorded in M_2 (pruning at 15thMay) and minimum fruit set (72.05 %) was recorded from the guava tree which was pruned at 15th June(M_4). Regarding level of pruning it is clear that the trees which were pruned with 10 cm produced higher fruit set percentage accounting 78.24. The interaction of pruning time and pruning intensity showed significant influenced in fruit set. The maximum fruit set (74.41.1%) was recorded both in M_2 P_3 (s at 30 cm of the shoot length in May) and M_1 P_2 (pruning at 20 cm of the shoot length in April 30) which was at par with all the treatment combination except in treatment M_3 P_1 (pruning at 10 cm of the shoot length in May) and M_1 P_2 (pruning at 20 cm of the shoot length in April 30th.) The present results might be due to the fact that after pruning the apical shots of the plants get removed leading to early new growth and better availability of photosynthetic solar radiations in leaves causing changes in the activities of growth regulators such as IAA enhancing flowering and fruit set. The research findings of [13], [14],[10],[5], [15] in guava fruits are in support with the present results .

Table 3 : Effect of pruning on fruit set (%) per tree in guava cv. Allahabad Safeda

Time of Pruning	Level of Pruning			
	(P_1)	**(P_2)**	**(P_3)**	**Mean M**
M_1	75.92	76.93	77.50	76.78
M_2	81.13	84.50	71.46	79.03
M_3	82.13	76.00	69.78	75.97
M_4	73.76	74.53	67.86	72.05
Mean P	78.24	77.99	71.65	

	FPLSD (p=0.05)
Effect of Time of Pruning (M)	
Effect of Level of Pruning (P)	5.22
Interaction (MXP)	
CD	8.16

Fruit weight (g)

The data reveals that the fruit weight was significantly influenced by difference in time of pruning with maximum fruit weight (148.09 g) in M_2 (15th May pruning) and 130.60 g was the least of all the treatments recorded in plants pruned on 30th April (M_1). Similarly, the different intensities of pruning also influenced the fruit weight. The effect of P_3 (pruning at 30 cm of the shoot length) was maximum with fruit weight (152.30 g) and the least (124.18 g) in P_1 (pruning at 10 cm of the shoot length). The interaction effect of time of pruning and pruning intensity showed non significant variation. The reasons for increased fruit weight was with delayed time and with increase in severity of pruning which might be due to the increase in number and area of leaves leading to an increase in the amount of photosynthates that cause a significant increase in fruit weight of guava. [5] opined that the fruit weight has direct correlation with the number of fruits borne on the trees. Accounting to high leaf to fruit ratio and availability of more photosynthates due to removal of current season's growth the fruits gained more weight. Similar results of [2], [17] and [18] in guava are in consonance with the present findings. [6],[19]and [10] also reported the same in guava fruits.

Table 4: Effect of pruning on fruit weight (g) in guava cv. Allahabad Safeda

Time of Pruning	Level of Pruning (P_1)	(P_2)	(P_3)	Mean M
(M_1)	117.26	130.11	144.43	130.60
(M_2)	131.4	150.59	162.30	148.09
(M_3)	125.66	138.34	159.10	141.03
(M_4)	122.39	130.62	143.38	132.13
Mean P	124.18	137.41	152.30	

	FPLSD (p=0.05)
Effect of Time of Pruning (M)	0.22
Effect of Level of Pruning (P)	0.19
Interaction (MXP)	0.38
CD	0.16

Yield (kg/tree)

The maximum fruit yield (28.68 kg/tree) was recorded in M_1 (30th April) with the least (22.42 kg/tree) yield produced in M_4 (mid June pruning). Pruning intensity showed significant effect on the fruit yield per tree. The maximum fruit yield (27.07 kg/tree) was recorded in P_3 (pruning at 30 cm of the shoot length) and least yield (23.62 kg/tree) was in P_1 (pruning at 10 cm of the shoot length).The interaction between the time of pruning and severity of pruning were also found to be significant with the maximum fruit yield (30.48 kg) recorded in M_1P_2 (pruning at 20 cm of the shoot length in 30th April). The increase in fruit yield of guava due to pruning might be due to the production of large number of flowering shoots, diversion of stored materials for production of healthy shoots, profuse flowering and higher fruit set. It also improved the light intensity reaching the canopy of the tree leading to more flower production on new shoots[6]. According to [20] a consistent increase in concentrations of tryptophan, proline and peroxidase levels in leaves, bark and the guava fruits and decreased content of phenols after pruning can be considered the favourable characters for increase in higher flowering and fruiting and ultimately higher yield. The present results conforms the findings of previous study of [21],[15],[16],[14] and [10] in guava fruits.

Table 5: Effect of pruning on yield (kg / tree) in guava cv. Allahabad Safeda

Time of Pruning	Level of Pruning (P_1)	(P_2)	(P_3)	Mean M
(M_1)	26.63	30.48	28.92	28.68
(M_2)	25.11	29.46	30.37	28.31
(M_3)	22.17	22.9	24.69	23.25
(M_4)	20.57	22.39	24.30	22.42
Mean P	23.62	26.31	27.07	

	FPLSD (p=0.05)
Effect of Time of Pruning (M)	0.668
Effect of Level of Pruning (P)	0.578
Interaction (MXP)	1.157
CD	2.67

Conclusion

From the results of the present study it can be concluded that different time of pruning and severity of pruning significantly affected the flowering, fruit set and yield. Pruning of 30 cm shoot length in mid-May was found to be the best among all the treatments for increasing yield of guava cv. Allahabad Safeda in subtropical climate of Punjab. Hence, the yield of guava for commercial production can be manipulated easily by appropriate pruning intensity and time intervals.

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