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Enhancing physical quality of fruits through pruning intensity on high density planting of mango cv. Amrapali

Anshuman Singh, Bhanu Pratap, Ravi Pratap Singh and Alok Kumar

Abstract
A field experiment was carried out at Main Experiment Station, Department of Fruit Science, Acharya Narendra Deva University of Agriculture & Technology, (Kumarganj), Ayodhya (U.P.) during the year 2019-2021. The experiment was conducted in Randomized Block Design with four treatments *i.e.* control (no pruning), light pruning (10 cm from apical end), moderate pruning (20 cm from apical end), severe pruning (30 cm from apical end) in five replications and considering one plants as a unit. The pruning was performed in the first week of August. The observations were recorded physical quality parameter properties of Amrapali variety of mango fruits give the different response of pruning intensities. The fruit size (length and width), fruit weight (g), fruit volume (CC) and pulp: stone ratio were recorded maximum with the severe pruning (30 cm from apical end) followed by moderate pruning (20 cm from apical end) and pulp weight (g), stone weight (g) were recorded maximum with the moderate pruning (20 cm from apical end).

Keywords: Mango, pruning intensity

Introduction
The mango (*Mangifera indica* L.) is a considered to be the king of fruit. It is, undoubtedly, one of the choicest and most ancient fruits known to mankind. Several authorities have testified to the origin of mango in the Indo Burma region. The mango which combine utility with beauty has the status of the national tree of India and is very rightly considered King among fruits grown in the country. Mango belongs to the family Anacardiaceae and genus Mangifera. The genus has 69 species, out of which only a few have edible fruits. In India only 3 species are found i.e. *Mangifera indica*, *Mangifera sylvatica* and *Mangifera coloneura*. The species Mangifera indica bears edible fruit.
The variety Amrapali was evolved by crossing the famous "Dashehari" variety of North with "Neelum" variety of South India. The fruit production and quality depends on several factors prevailing during their growth and development. Amongst the several factors, pruning is an important cultural operation for obtaining quality yield from the fruiting trees, which involves judicious removal of vegetative parts. The objective of pruning is to produce more and high quality marketable fruit at a low cost.

Materials and Methods
The experiment was carried out at Main Experiment Station, Department of Fruit Science, College of Horticulture and Forestry, Acharya Narendra Deva University of Agriculture and Technology, Kumarganj, Ayodhya, Uttar Pradesh during year 2019- 20 and 2020- 21. Twenty-five-year-old bearing mango trees of cv. Amrapali of uniform vigour and size and planted under high density (2.5 x 2.5 m) were selected for the present studies. All the trees were maintained under uniform cultural practices during the course of investigation. The experiment was laid out as per Randomized Block Design (R.B.D.). All the treatments were replicated five times and one tree served as a unit of treatment in each replication. The total number of trees marked for the experiment were twenty. The pruning was performed in the first week of August. Three intensity of pruning. i.e. severe (removal of branches with 30 cm from apical end), moderate (removal of branches with 20 cm from apical end) and mild (removal of branches with 10 cm from apical end) was done manually using pruning saw and secateurs.

Bio-physical parameter

1. **Fruit weight:** Weight of five mature ripe fruits were recorded by weighing the samples on a open pan balance. Average weight of a fruit was calculated and expressed in gram.
2. **Fruit size:** Fruit size in terms of length from the apex to stem end and maximum diameter were recorded by Vernier callipers and these parameters were expressed in terms of centimetres.
3. **Fruit volume:** The data on the fruit volume was recorded by water displacement method. Average fruit volume was expressed in terms of Cubic centimetre.
4. **Stone and pulp weight (g):** The weight of stone was recorded by physical balance and the average stone weight was calculated and expressed in g. Pulp weight was obtained by deducting the weight of seed (stone) and peel and expressed in g.
5. **Pulp: stone ratio:** This was calculated by the weighing the ripen fruits seperately, followed by pulp and stone after peeling of fruit.

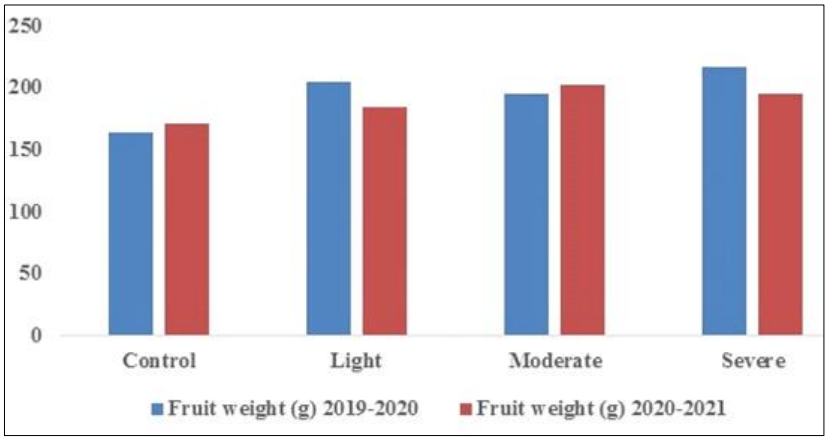
Results and Discussions

Fruit quality

Fruit weight (g): The effect of pruning treatment on fruit weight and total production is summarised in Table 1 and Graph 1. The statistics clearly show that tree pruning increased fruit weight substantially when compared to the control. During 2019-2020, the largest fruit weight (216.64 g) was obtained in severely pruned trees, while the 204.66 g and 195.12 g found in light and moderate pruning treatments, respectively, were not significantly different. The greatest fruit weight (202.56 g) was observed in the second year (2020-2021), although it was significantly different in the severe and light pruning treatments, with 194.89 g and 184.35 g, respectively.

Table 1: Effect of pruning on fruit weight (g) in mango cv. Amrapali

Treatments	Fruit weight (g)	
	2019-2020	2020-2021
Control	163.46	171.50
Light	204.66	184.35
Moderate	195.12	202.52
Severe	216.64	194.89
Mean	194.97	188.31
S. Em ±	0.87	0.81
C.D. at 5%	2.73	2.52



Graph 1: Effect of pruning on fruit weight (g) in mango cv. Amrapali

Similarly, for all of the pruning severity tests, the fruit weight was shown to be greatly improved. Because it grew a smaller quantity of fruits, fruit weight on severely pruned trees was generally superior to other treatments. It's also possible that because there were fewer fruits, they didn't compete with each other as much as low-severity fruits did, and so got larger in size and weight. Burondkar *et al*. have previously discovered similar observations with mango (2000) [6]. Choudhary *et al*. (2018) [7] found that the maximum fruit weight in custard apple was (305.21 g).

Fruit size (cm)

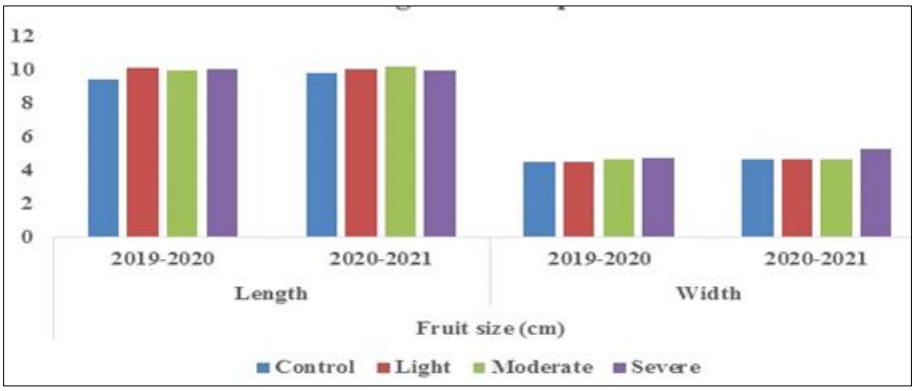
The pruning treatments resulted in a significant increase in fruit length (Table 2 and Graph 2). Light pruned trees produced the longest (10.12 cm) fruits during the first season, followed by severe (10.04 cm) and moderate (9.96 cm) pruning intensities. Over the control group, the treatment effects were considerable (9.44 cm). During the second season, moderate pruning produced the longest fruit (10.18 cm), while light and severe pruning produced fruit lengths of 10.08 cm and 9.96 cm, respectively, which were statistically comparable but significant over control (9.82 cm).

Table 2: Effect of pruning on fruit size (cm) in mango cv. Amrapali

Treatments	Fruit size (cm)			
	Length		Width	
	2019-2020	2020-2021	2019-2020	2020-2021
Control	9.44	9.82	4.51	4.62
Light	10.12	10.08	4.52	4.68
Moderate	9.96	10.18	4.68	4.66
Severe	10.04	9.96	4.74	5.28
Mean	9.89	10.01	4.61	4.81
S. Em ±	0.23	0.14	0.10	0.23
C.D. at 5%	0.73	0.46	0.32	NS

Similarly, fruit width did not alter much with pruning; however, heavy pruning (4.74 cm) resulted in the maximum width, which was significantly greater than the unpruned control (4.51 cm). In comparison to the unpruned control, the fruit width with severe pruning (4.74 cm) and moderate pruning (4.68 cm) was likewise significant.

In the second year, severe pruning (5.28 cm) produced the greatest width, followed by light pruning (4.68 cm) and moderate pruning (4.66 cm), both of which were insignificant in comparison to the unpruned control (4.62 cm).



Graph 2: Effect of pruning on fruit size (cm) in mango cv. Amrapali

Pruning has been shown to improve the vegetative and reproductive behaviour of orchard plants by improving the microclimate. Increased photosynthetic rate leads to more assimilates being transported to the developing and active sink, i.e. fruit. Fruit sizes are superior and equivalent to those borne on young plants in terms of length and width. The intensity of pruning, i.e. severe, moderate, and light, was said to have a considerable impact on the size and look of the fruit. Pruning had previously been shown to increase fruit size in mango (Singh *et al*., 2010) [5] and other crops such as custard apple (Singh *et al*., 2010). [5] Choudhary *et al*. (2018) [7] discovered that 90 cm of pruning intensity resulted in the largest fruit polar diameter (9.02 cm).

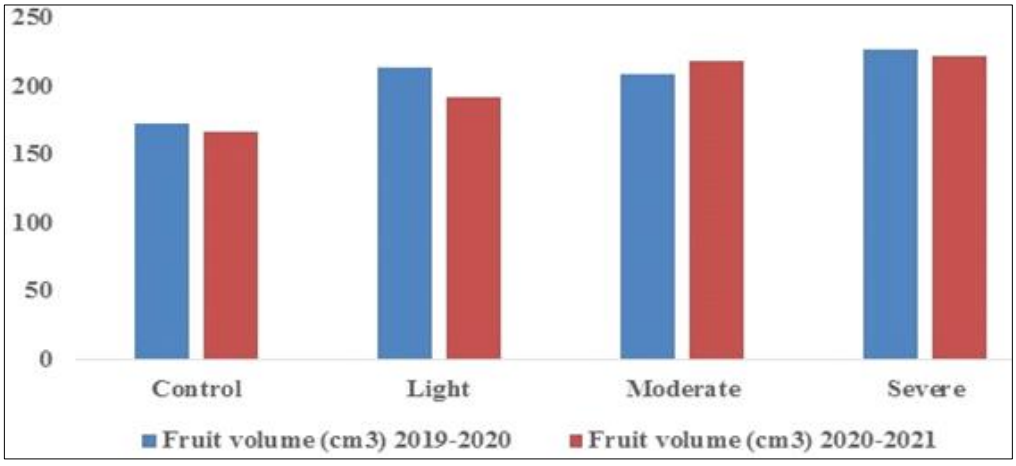
Fruit volume (cm^3)

Fruit volume, like fruit length and breadth, was greatly improved by tree pruning. The data (Table 3 and Graph 3) show that, irrespective of the pruning severity, fruit volume was increased when compared to the control. Severely pruned trees had the highest volume (227.28 cm3), followed by light (214.14 cm3) and moderate (208.82 cm3) pruning treatments. All of the treatments outperformed the control group (172.90 cm3).

Table 3: Effect of pruning on volume (cm^3) in mango cv. Amrapali

Treatments	Fruit volume (cm^3)	
	2019-2020	2020-2021
Control	172.90	167.04
Light	214.14	192.44
Moderate	208.82	218.94
Severe	227.28	221.64
Mean	205.78	200.01
S. Em ±	1.03	0.79
C.D. at 5%	3.22	2.48

Severe (221.64 cm3) pruning produced the most fruit volume, followed by moderate (218.94 cm3) and light (192.44 cm3) pruning, all of which were significantly superior to the unpruned control (167.04 cm3).



Graph 3: Effect of pruning on volume (cm^3) in mango cv. Amrapali

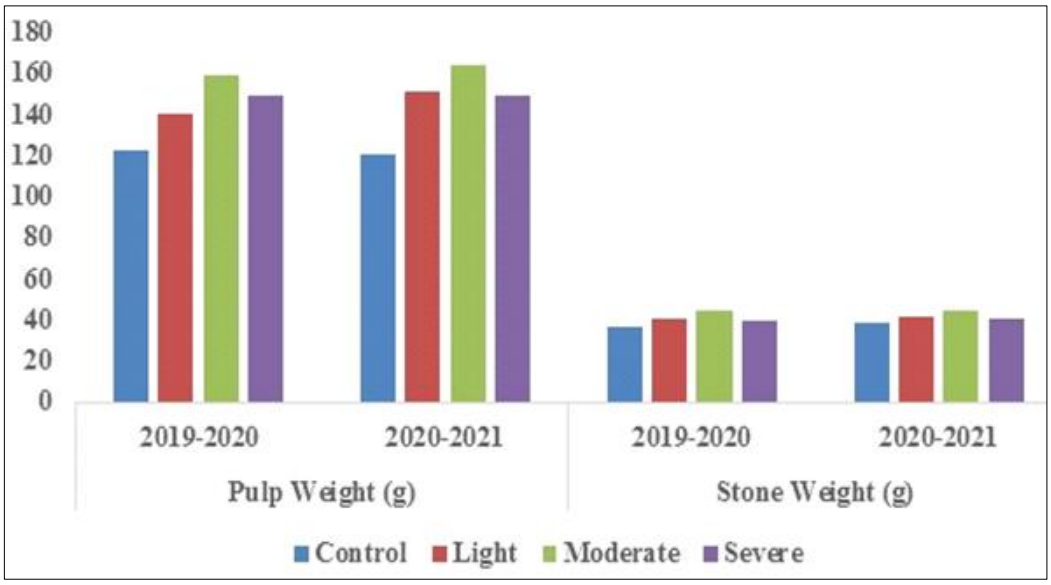
Pruning has been shown to improve the vegetative and reproductive behaviour of orchard plants by improving the microclimate. Increased photosynthetic rate causes more assimilates to be transported to the developing and active sink, resulting in fruit volume that is superior to that of immature plants. Mango fruit quantities were shown to be greatly improved as a result of heavy pruning (Singh *et al*., 2010) [5].

Fruit pulp and stone weight (g)

Table 4 and Graph 4 show the influence of pruning on fruit pulp and stone weight (g) and ratio in mango cv. Amrapali. The findings clearly show that during both seasons, the weight of both the fruit pulp and the stone increased irrespective of treatment. Table 4.24 further shows that the pruning intensities had a substantial impact on fruit pulp and stone weight (g). In both seasons, the light pruning intensity resulted in a considerable increase in pulp (151.38 g) and stone weight (41.34 g) compared to the control. A similar pattern was observed in moderate pruning in both pruning seasons, with a rise in pulp and stone weight (164.28 g and 44.48 g, respectively), respectively. During both seasons, however, severe pruning has reduced the pulp and stone weight. In the control group, however, there was a slight increase in stone weight (38.81 g) from 2020 to 2021.

Table 4: Effect of pruning on fruit pulp and stone weight (g) in mango cv. Amrapali

Treatments	Pulp Weight (g)		Stone Weight (g)	
	2019-2020	2020-2021	2019-2020	2020-2021
Control	122.84	120.88	37.02	38.81
Light	140.38	151.38	41.02	41.34
Moderate	158.62	164.28	44.28	44.48
Severe	148.82	149.22	40.00	40.98
Mean	142.66	146.44	40.58	41.40
S. Em ±	0.21	0.13	0.66	1.32
CD. at 5%	0.67	0.43	2.07	NS



Graph 4: Effect of pruning on fruit pulp and stone weight (g) in mango cv. Amrapali

Custard Apple Choudhary *et al*. (2018) [7] observed that 90 cm of pruning intensity resulted in the highest pulp content (54.34 percent). In 90 cm, the lowest percentage of seed (7.68 percent) was observed.

Pulp: stone ratio

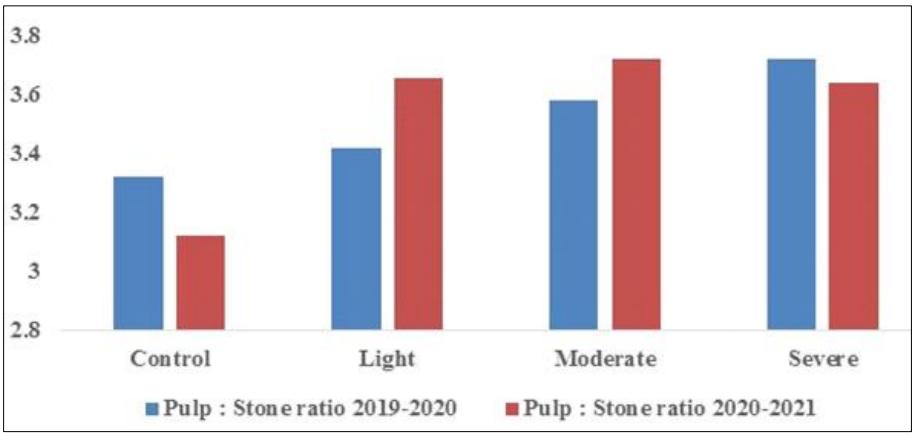
In terms of pulp: stone ratio, there were minor differences amongst the treatments (Table 5 and Graph 5). The findings ranged from a maximum (3.72) in the severe pruned treatment to a minimum (3.32) in the control throughout the first year, but it was significant. The highest ratio (3.72) was obtained for moderately pruned trees in the second year, followed by light (3.66) and severe (3.64) pruning treatments. The control had a 3.12 ratio, which was much lower than the various pruning treatments.

In fruit production, the percentage of pulp or weight per fruit is an important concern. Consumers and processors are interested in the amount of pulp in fruit. To a grower, even a small increase in pulp or reduction in stone size as a result of pruning might signify a lot. In severe or moderately pruned trees, a higher pulp: stone ratio was obtained, which could be attributable to an increase in fruit size and weight (Singh *et al*., 2010) [5].

Table 5: Effect of pruning on fruit pulp: stone ratio in mango cv. Amrapali

Treatments	Pulp: Stone ratio	
	2019-2020	2020-2021
Control	3.32	3.12
Light	3.42	3.66
Moderate	3.58	3.72
Severe	3.72	3.64
Mean	3.51	3.53
S. Em ±	0.06	0.10
CD. at 5%	0.18	0.33

Similar findings were found by Bhanu pratap *et al*. (2009) [3], who discovered that moderate mango pruning produced the maximum pulp weight (169.77g) and stone weight (43.25g).



Graph 5: Effect of pruning on fruit pulp: stone ratio in mango cv. Amrapali

During both years, the ratio of pulp to stone was highest in severely pruned trees. The pulp stone ratio was highest in the fruit of trees pruned at the 8th bud level, according to Ber Gupta *et al*. (2015) [1].

Summary and Conclusion

Fruit size (length and width) was maximum in light pruning followed by severe pruning treatments. Similarly, fruit volume was maximum in severe pruning followed by light and or moderate pruning. All the treatments were significantly superior to that of control. Mean fruit weight was higher (over 185 g) in pruned trees in comparison to control (163 to 171 g). Fruit quality in terms of pulp and stone weight and pulp: stone ratio were significantly improved with the pruning treatments compared to control. Moderate pruning though bore few fruits of larger size but gave high pulp (158.62 and 164.28 g) followed by severe pruning (148.82 and 149.22 g) and accordingly higher pulp: stone ratio (3.72) was found in moderately pruned trees.

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