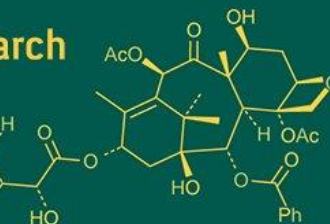
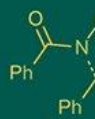
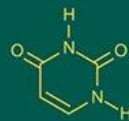
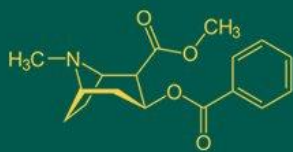


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Effect of pruning and thinning on quality production of pomegranate (*Punica granatum* L.) cv. Bhagwa

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Abstract

The present study, titled “Effect of Pruning and Thinning on Quality Production of Pomegranate (*Punica granatum* L.) Cv. Bhagwa,” was carried out during 2024-2025 in a six-year-old pomegranate orchard spaced at 4×3 m in the Department of Horticulture, College of Agriculture, Badnapur, Taluka Badnapur, District Jalna. The experiment followed a Randomized Block Design with seven treatments: T₁ (20 cm pruning with thinning at flowering), T₂ (20 cm pruning with thinning at fruiting), T₃ (30 cm pruning with thinning at flowering), T₄ (30 cm pruning with thinning at fruiting), T₅ (40 cm pruning with thinning at flowering), T₆ (40 cm pruning with thinning at fruiting), and T₇ (control), each replicated three times. The objective was to identify the most suitable pruning and thinning combination for improving pomegranate fruit quality. Observations related to quality parameters were recorded accordingly.

Different pruning and thinning levels had a significant effect on the fruit quality characteristics. Among the treatments, T₄ (30 cm pruning with thinning at the fruiting stage) resulted in the highest average fruit weight (277.45 g), fruit volume (284.04 ml), and aril weight per fruit (141.93 g). Meanwhile, T₆ (40 cm pruning with thinning at the fruiting stage) produced the highest total soluble solids (17.64%), reducing sugars (11.57%), non-reducing sugars (0.30%), and total sugars (12.88%), along with the lowest titratable acidity (0.32%).

Keywords: Quality, pomegranate, pruning, thinning

Introduction

Pomegranate (*Punica granatum* L.) belongs to the family Punicaceae and has a chromosome number of $2n = 16$ or 18 . It is one of the oldest known edible fruits and can thrive across a wide range of agro-climatic conditions, from tropical to temperate regions, though it is primarily cultivated in tropical and subtropical areas. The crop is believed to have been domesticated in the Middle East around 5,000 years ago and is regarded as one of the earliest domesticated fruit species, along with fig, date palm, grape, and olive. The scientific name *Punica granatum* originates from the Latin words *Pomum* (apple) and *Granatus* (seeded), meaning “seeded apple.” The family Punicaceae comprises a single genus, *Punica*, which includes two species: *P. granatum* L. and *P. protopunica* Balf. f. The species *P. granatum* is further categorized into two subspecies *Chlorocarpa* and *Porphyrocarpa*.

The pomegranate is native to Iran and is extensively cultivated across Mediterranean regions such as Spain, Morocco, Egypt, Afghanistan, and Baluchistan. It is also grown to a limited extent in Burma, China, Japan, the United States (California), and India. In India, pomegranate is cultivated on approximately 2.32 lakh hectares, producing about 12.47 MT/ha (Anonymous, 2024) [1]. Maharashtra is the leading producer, followed by Andhra Pradesh, Karnataka, Gujarat, Rajasthan, Madhya Pradesh, Uttar Pradesh, Tamil Nadu, Punjab, and Haryana. Major pomegranate-growing districts in Maharashtra include Solapur, Nashik, Sangli, Ahilyanagar, Pune, Dhule, Chhatrapati Sambhajnagar, Satara, Dharashiv, and Latur. The state contributes nearly 54.85% of the country's total production. Maharashtra alone cultivates around 1.13 lakh hectares, producing 13.65 lakh metric tonnes with a productivity of 12.06 MT/ha (Anonymous, 2024) [1]. About 52% of the total fruit weight is edible, and one kilogram of pomegranates yields approximately 452-500 ml of juice.

Pomegranate juice contains 15-19% sugars. The edible portion of the fruit is the aril a juicy covering that surrounds each seed. These arils are nutritionally valuable, providing Vitamin C (16 mg/100 g), minerals (0.7%), calcium (10 mg/100 g), phosphorus (70 mg/100 g), and iron (0.3 mg/100 g), along with notable quantities of acids, fats, and carbohydrates (Bhowmik *et al.*, 2013) [3]. Pomegranates are widely appreciated for their sweet-tart flavor and are used both fresh and processed into products such as juice, concentrate, beverages, wine, syrup, and jelly. The dried seeds, known as "anardana," are also a popular product. Besides being consumed as a dessert fruit, pomegranate juice is valued for its medicinal properties and is used in treating ailments such as leprosy, diarrhea, dysentery, and hemorrhages. Juice from wild pomegranates contains citric acid and sodium citrate, which are used for pharmaceutical applications (Shastri & Pawar, 2014) [20]. More recently, pomegranate extracts have been reported to possess anti-cancer properties.

Materials and Methods

The experiment was carried out during 2024-25 at the Department of Horticulture, College of Agriculture, Badnapur, Taluka Badnapur, District Jalna. The study was conducted in a six-year-old pomegranate orchard spaced at 3 × 4 m. Geographically, Badnapur is located at 19.868223° N latitude and 75.723747° E longitude. In degrees, minutes, and seconds (DMS), the coordinates are 19° 52' 5.6028" N and 75° 43' 25.4892" E, which are also the coordinates for the College of Agriculture, Badnapur. The region falls within the Marathwada zone of Maharashtra and lies in a semi-arid tropical climatic belt.

The experiment was designed using a Randomized Block Design with seven treatments: T₁ (pruning at 20 cm with thinning at flowering), T₂ (pruning at 20 cm with thinning at fruiting), T₃ (pruning at 30 cm with thinning at flowering), T₄ (pruning at 30 cm with thinning at fruiting), T₅ (pruning at 40 cm with thinning at flowering), T₆ (pruning at 40 cm with thinning at fruiting), and T₇ (control), each replicated three times. Observations were recorded on fruit weight (g), fruit volume (ml), aril weight per fruit (g), total soluble solids (%), titratable acidity (%), reducing sugars (%), non-reducing sugars (%), and total sugars (%). Statistical analysis was performed following the methods outlined by Panse and Sukhatme (1967).

Results and Discussion: Fruit Weight (g)

The results indicated that fruit weight varied significantly among the different pruning and thinning treatments. The highest fruit weight (277.45 g) was recorded in treatment T₄ (pruning at 30 cm with thinning at the fruiting stage), which was statistically comparable to T₃ (pruning at 30 cm with thinning at the flowering stage, 264.09 g) and T₆ (pruning at 40 cm with thinning at the fruiting stage, 251.60 g). In contrast, the lowest fruit weight (181.91 g) was observed in the control treatment (T₇). The increase in fruit weight under severe pruning may be attributed to the availability of more photosynthates for a reduced number of fruits. Thinning also contributed by lowering the fruit load, thereby enhancing fruit growth and improving individual fruit weight. Similar findings have been reported by Bhuva *et al.* (2018) [5] in pomegranate and Dahapute *et al.* (2018) [8] in custard apple.

Volume of Fruit (ml)

The highest fruit volume (238.04 ml) was observed in treatment T₄ (pruning at 30 cm with thinning at the fruiting stage), and this result was statistically on par with treatments

T₃, T₆, T₅, and T₂ (pruning at 20 cm with thinning at the fruiting stage). The minimum fruit volume (167.21 ml) was recorded in the control treatment (T₇).

The increase in fruit volume may be due to reduced crop load in the severely pruned and thinned trees, which allowed greater translocation of nutrients to the remaining fruits, resulting in larger fruit size. Similar observations were reported by Pratap *et al.* (2009) [13] in mango and Sahar and Hameed (2014) [16] in guava.

Weight of Arils Per Fruit (g)

The results indicated that aril weight differed significantly across the treatments. Treatment T₄ (pruning at 30 cm with thinning at the fruiting stage) recorded the highest aril weight (145.13 g), followed by T₃ (pruning at 30 cm with thinning at the flowering stage, 132.96 g), T₆ (pruning at 40 cm with thinning at the fruiting stage, 129.93 g), and T₅ (pruning at 40 cm with thinning at the flowering stage, 126.73 g). The lowest aril weight (98.18 g) was noted in the control (T₇).

Pruning and thinning levels significantly influenced aril weight, with T₄ producing the maximum value (145.13 g). The increase in fruit weight, fruit size, and aril weight may be attributed to reduced fruit load due to pruning and thinning, which enhanced nutrient distribution and resource allocation. With fewer fruits to support, the plant could channel more assimilates to each developing fruit, resulting in heavier and better-developed arils. Similar findings have been reported by Chavan (2018) [6] and Mohsen and Osman (2015) [12] in pomegranate.

Total Soluble Solids (%)

The results showed that total soluble solids (TSS) were significantly influenced by the different pruning and thinning treatments. The highest TSS (17.64%) was recorded in treatment T₆ (pruning at 40 cm with thinning at the fruiting stage), which was statistically comparable with T₅ (17.34%), T₄ (17.05%), and T₃ (16.79%). The lowest TSS value (15.49%) was observed in the control treatment (T₇).

The increase in TSS in fruits from pruned trees may be attributed to improved carbohydrate availability, as pruning enhances the accumulation of stored reserves in the shoots. Thinning further contributes by reducing the number of fruits, allowing better nutrient distribution to the remaining fruits, which in turn raises the TSS. These findings are in line with the observations of Sheikh and Rao (2002) [18] in pomegranate and Dahapute *et al.* (2018) [8] in custard apple.

Titrate Acidity (%)

The results showed that the highest titratable acidity (0.39%) was recorded in the control treatment (T₇), which may be attributed to the absence of pruning. The lowest titratable acidity (0.32%) was observed in treatment T₆ (pruning at 40 cm with thinning at the fruiting stage). This reduction in acidity may be due to the combined effect of pruning and thinning, which enhances fruit quality by improving the sugar-acid balance and generally leads to lower acidity. Thinning may also slow the decline in acidity by slightly delaying the maturation process. Similar findings have been reported by Bhagawati *et al.* (2015) [4] in guava and by Thakur and Chandel (2004) [21].

Reducing Sugars (%)

The data showed that reducing sugar content varied significantly across the pruning and thinning treatments. The highest reducing sugars (11.57%) were recorded in

treatment T₆ (pruning at 40 cm with thinning at the fruiting stage), which was statistically on par with T₅ (11.31%), T₄ (11.04%), and T₃ (10.72%). The lowest reducing sugar content (9.79%) was observed in the control treatment (T₇). The increase in reducing sugars in treatment T₆ may be attributed to enhanced nutrient uptake by the trees, which leads to greater synthesis of carbohydrates and other metabolites and their subsequent movement into the developing fruits. Thinning also contributed by increasing fruit size and weight, thereby improving the concentration of reducing sugars. These findings align with the results reported by Kadam *et al.* (2018)^[11] in custard apple.

Non-Reducing Sugars (%)

The results showed that the highest non-reducing sugar content (1.30%) was obtained in treatment T₆ (pruning at 40 cm with thinning at the fruiting stage), while the lowest value (1.12%) was recorded in the control treatment (T₇). The increase in non-reducing sugars under pruning treatments may be attributed to improved nutrient uptake, which enhances the synthesis of carbohydrates and other metabolites and their translocation to the fruits. Thinning also reduced the crop load, thereby increasing the leaf-to-

fruit ratio, which promoted greater production and accumulation of non-reducing sugars in the remaining fruits. Similar findings have been reported by Kadam *et al.* (2018)^[11] and Rab *et al.* (2012)^[15].

Total Sugars (%)

The results indicated that total sugar content varied significantly among the pruning and thinning treatments. The highest total sugars (12.88%) were recorded in treatment T₆ (pruning at 40 cm with thinning at the fruiting stage), which was statistically at par with T₅ (12.59%), T₄ (12.28%), and T₃ (11.91%). The lowest total sugar content (10.91%) was observed in the control treatment (T₇).

The maximum total sugars in treatment T₆ may be attributed to enhanced nutrient uptake, leading to increased synthesis of carbohydrates and other metabolites and their movement into the developing fruits. Thinning also reduced the number of fruits, enabling a greater share of photosynthates from the leaves to be allocated to the remaining fruits, thereby raising total sugar levels. These findings are consistent with the reports of Sharma and Singh (2018)^[17] and Abeer and Mohsen (2010)^[2].

Sr. No.	Treatment	Weight of fruit (g)	Volume of fruit (ml)	Weight of arils/fruit (g)
1	T ₁ -Pruning at 20 cm and thinning at the flowering stage	207.21	194.42	118.14
2	T ₂ - Pruning at 20 cm and thinning at the fruiting stage	228.76	208.17	119.15
3	T ₃ - Pruning at 30 cm and thinning at the flowering stage	264.09	230.27	132.96
4	T ₄ - Pruning at 30 cm and thinning at the fruiting stage	277.45	238.04	145.13
5	T ₅ - Pruning at 40 cm and thinning at the flowering stage	239.19	217.95	126.73
6	T ₆ - Pruning at 40 cm and thinning at the fruiting stage	251.60	225.28	129.93
7	T ₇ - (control)	181.91	167.21	98.18
	S.E +	11.15	13.94	8.40
	C.D at 5% level	34.35	42.96	25.88

Sr. No.	Treatment	Total soluble solids (%)	Titration Acidity (%)	Reducing sugars (%)	Non-reducing sugars (%)	Total sugars (%)
1	T ₁ - Pruning at 20 cm and thinning at the flowering stage	16.19	0.38	10.23	1.16	11.39
2	T ₂ - Pruning at 20 cm and thinning at the fruiting stage	16.51	0.38	10.48	1.17	11.65
3	T ₃ - Pruning at 30 cm and thinning at the flowering stage	16.79	0.37	10.72	1.19	11.91
4	T ₄ - Pruning at 30 cm and thinning at the fruiting stage	17.05	0.35	11.04	1.24	12.28
5	T ₅ - Pruning at 40 cm and thinning at the flowering stage	17.34	0.34	11.31	1.28	12.59
6	T ₆ - Pruning at 40 cm and thinning at the fruiting stage	17.64	0.32	11.57	1.30	12.88
7	T ₇ - (control)	15.49	0.39	9.79	1.12	10.91
	S.E +	0.32	0.01	0.33	0.03	0.36
	C.D at 5% level	0.98	0.04	1.02	0.12	1.11

Conclusion

The results of the study clearly demonstrated that varying intensities of pruning and thinning had a significant impact on the quality attributes of pomegranate. Overall, treatment T₄ (pruning at 30 cm combined with thinning at the fruiting stage) was the most effective in increasing fruit yield, whereas treatment T₆ (pruning at 40 cm with thinning at the fruiting stage) produced the best improvement in fruit quality.

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