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Comparative Evaluation of Commercial Pomegranate (*Punica granatum* L.) Cultivars under Semi-Arid Conditions of Western Maharashtra, India

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Abstract— *Pomegranate (Punica granatum L.) is an important fruit crop cultivated widely in the semi-arid regions of India, particularly in Western Maharashtra. Identifying suitable cultivars that perform well under these climatic conditions is essential for improving productivity and fruit quality. A field experiment was conducted under semi-arid conditions at the ICAR–National Research Centre on Pomegranate, Solapur, to comparatively evaluate five commercially grown cultivars: Bhagwa, Super Bhagwa, Solapur Lal, Sharad King, and Ganesh. The study was carried out using a randomized block design (RBD) with four replications. Observations were recorded on vegetative growth, flowering behavior, fruit yield, and important fruit quality attributes. The results revealed significant differences among the cultivars for most of the parameters studied. Among the evaluated cultivars, Bhagwa produced the longest new shoots (32.10 cm), recorded the highest fruit yield (25.10 kg per plant), and exhibited superior juice recovery (51.20%). Solapur Lal showed comparatively higher total soluble solids (16.50 °Brix), indicating better fruit sweetness and quality. In contrast, the traditional cultivar Ganesh showed comparatively lower performance in several growth, yield, and quality parameters. Overall, the results suggest that improved cultivars, such as Bhagwa and Solapur Lal, are better suited to cultivation under the semi-arid agro-climatic conditions of Western Maharashtra and can contribute to enhanced productivity and improved fruit quality in commercial pomegranate production.*

Keywords— ***Pomegranate, cultivars, semi-arid climate, yield, fruit quality, Bhagwa, Solapur Lal, Super Bhagwa.***

I. INTRODUCTION

Pomegranate (*Punica granatum* L.) belongs to the family Lythraceae (2n = 16) and is an economically important fruit crop cultivated widely across tropical and subtropical regions (Holland et al., 2009). Commonly called the "Carthaginian apple" or the "Fruit of Paradise," it is considered one of the oldest and most versatile fruit crops in the world. The crop is thought to have originated in the area stretching from Iran to the Himalayas in northern India, from where its cultivation gradually spread to the Mediterranean basin and other tropical and subtropical regions (Özgüven et al., 2009). In India, pomegranate has become a high-value commercial fruit crop and plays a key role in improving farmers' livelihoods, especially in arid and semi-arid areas (Chandra et al., 2010). Its strong drought tolerance and adaptability to a variety of soil types

make it suitable for cultivation in regions with limited water supply (Al-Mansour et al., 2025).

Maharashtra leads India's pomegranate industry, accounting for over 70% of the nation's total production. (Varpe et al., 2025) The state of Western Maharashtra, including Solapur, Sangli, Nashik, and Ahmednagar, has become the country's "pomegranate hub". (Kaur, 2025) The semi-arid climate of this region, marked by high temperatures, low rainfall, and low humidity, creates ideal conditions for growing high-quality pomegranates. (Patil et al., 2018) However, maintaining this success relies heavily on selecting cultivars that can maximize both yield and quality under these specific climatic conditions (Horticulture Statistics Division, 2021).

Historically, the 'Ganesh' cultivar, developed at the Ganeshkhind Fruit Experiment Station in Pune, revolutionized pomegranate cultivation in India thanks to its soft seeds and sweet flavor. (Popular Guava and Pomegranate Varieties in India, 2024) While Ganesh was the industry standard for decades, the demand for better fruit color, higher yield, and longer shelf life led to the introduction of the 'Bhagwa' variety. Bhagwa quickly became the preferred choice for export markets because of its glossy red skin and resistance to fruit cracking. (Pomegranate Varieties in India for Export: A Gateway to Global Markets, 2023). Despite Bhagwa's success, the agricultural scientific community continues to seek varieties with improved nutritional profiles, greater resistance to bacterial blight (*Xanthomonas axonopodis* pv. punicae), and better fruit recovery (Jalikop et al., 2010).

In recent years, several new cultivars and selections such as Super Bhagwa, Solapur Lal, and Sharad King have been introduced to the market. Bhagwa is often praised for its larger fruit size and higher productivity compared to Super Bhagwa. Solapur Lal, developed through rigorous breeding programs by the National Research Centre on Pomegranate, is promoted for its high antioxidant content and vibrant red arils (Babu et al., 2022). Sharad King, another promising selection, has gained popularity among local growers for its excellent fruit retention and juice recovery (Shilpa et al., 2024; Biswas, 2025). Despite their availability, there is a significant research gap in a comprehensive, direct comparison of these newer cultivars under the specific microclimatic conditions of Western Maharashtra.

The vegetative growth of a pomegranate tree, defined by parameters such as shoot length, leaf count, and leaf area, is the foundation of its reproductive success. Strong vegetative growth supports a high photosynthetic rate, which in turn leads to better flowering and fruit production (Xie et al., 2008). Studies have shown that semi-arid conditions can significantly reduce vegetative vigor if the cultivar is not well-adapted (Babu et al., 2011). Additionally, pomegranate flowering behavior is complex, involving male, hermaphrodite (bisexual), and intermediate flowers. The ratio of hermaphrodite flowers, which are the only ones that develop into fruits, is highly sensitive to temperature and nutrient management (Ikram et al., 2022). Identifying cultivars that naturally produce a higher percentage of hermaphrodite flowers in semi-arid environments is essential for maintaining stable yields (Pareek et al., 2015).

Yield performance is the main benchmark for any commercial cultivar. In a semi-arid environment, yield depends not only on the number of fruits per plant but also on individual fruit weight and total tonnage per acre. Export-focused farming requires fruits to meet specific weight categories (typically 250g to 400g). (Pomegranate Exporter from India | Mahavir Export, n.d.) Varieties that do not reach these weight benchmarks even under optimal management pose a financial risk to the farmer. Therefore, assessing the yield potential of Bhagwa and Sharad King compared to traditional Super Bhagwa and Ganesh is an urgent economic concern for the region's growers (Sheikh, 2006).

Beyond physical yield, the fruit's internal quality, as measured by Total Soluble Solids (TSS), sugar content, and juice recovery, determines its marketability for both fresh consumption and processing. High TSS values (expressed in °Brix) indicate sweetness, which is a primary consumer preference in India (Pons-Gómez et al., 2024). Similarly, juice recovery percentage is a critical factor for the growing pomegranate processing industry (Chandra et al., 2013). Cultivars such as Solapur Lal have been bred to improve these internal quality parameters, but their performance must be validated alongside established commercial varieties (NRC Pomegranate, 2019).

The present study, titled "Comparative Evaluation of Commercial Pomegranate (*Punica granatum* L.) Cultivars under Semi-Arid Conditions of Western Maharashtra," was designed to address these research needs. The main objective is to systematically document the vegetative growth, flowering patterns, yield potential, and physical-chemical quality of five leading cultivars: Bhagwa, Super Bhagwa, Solapur Lal, Sharad King, and Ganesh. Through this comparative analysis, the research aims to provide farmers, exporters, and scientists with data-driven recommendations on which cultivars are best suited for the challenging yet rewarding climate of Western Maharashtra.

In conclusion, as the global demand for pomegranates continues to increase due to their recognized health benefits—including high levels of Vitamin C, polyphenols, and anti-inflammatory properties—the need for high-

quality cultivars becomes crucial. (Bioactive compounds and health benefits of pomegranate: An updated narrative review, 2023) This research provides a scientific basis for cultivar selection, helping the pomegranate industry in Western Maharashtra remain competitive, sustainable, and profitable amid evolving agricultural challenges.

II. MATERIALS AND METHODS

2.1 Experimental Site and Location

The research was carried out at the National Research Centre on Pomegranate (NRCP) in Solapur, Maharashtra, India. The experimental site is situated at 17°10′ N latitude and 74°42′ E longitude, at an elevation of 483.5 meters above sea level. The study took place in the center's experimental orchards and Fruit Culture Laboratory.

The region receives an average yearly rainfall of 550-650 mm, which is often unpredictable and unevenly distributed. Summers are characterized by high temperatures, with average maximums ranging from 38 to 42°C, while winters have average minimums between 10 and 15°C. Relative humidity usually varies from 35 to 70 percent, depending on the season. The soil at the experimental site is primarily medium-black (Vertisol), with a pH range of 7.5 to 8.2, making it suitable for pomegranate cultivation. These conditions reflect the typical semi-arid climate of Western Maharashtra.

2.2 Experimental Material and Design

The present investigation evaluated five commercially important pomegranate cultivars: Bhagwa, Super Bhagwa, Solapur Lal, Sharad King, and Ganesh, with Ganesh as the control variety. The field trial was arranged in a Randomized Block Design (RBD) with four replications at a standard spacing of 4.5 m by 3.0 m. The research was conducted during the 2024-2025 season under Ambe Bahar's management. Water stress was imposed in December 2024, followed by the first irrigation (Bahar initiation) in the first week of January 2025 to induce uniform flowering. Standard agricultural practices, including drip irrigation, pruning, and integrated nutrient management, were consistently applied in accordance with ICAR-NRCP guidelines.

2.3 Sampling and Data Collection

To ensure statistical accuracy, twenty (20) shoots were randomly selected and tagged from each plant across all replications for recording vegetative and reproductive observations. For the evaluation of fruit physical and chemical characteristics, ten (10) representative fruits from each variety were harvested at physiological maturity based on skin color and the characteristic metallic sound upon tapping.

2.4 Morphological and Vegetative Parameters

Vegetative growth was evaluated using the following parameters:

- **Plant Architecture:** Plant height (cm), number of primary branches, and number of secondary branches were recorded.
- **Shoot and Foliage:** Shoot length (cm) and the total number of leaves per shoot were measured.
- **Leaf Area:** Total leaf area per shoot (cm^2) was calculated for the tagged shoots using a digital leaf area meter.

2.5 Reproductive and Yield Parameters

- Observations on flowering and fruit development were recorded during the Ambe Bahar (January to July 2025) on the tagged shoots:
- **Flowering:** The total number of flowers per shoot and the number of hermaphrodite flowers were recorded from January to March 2025.
- **Fruit set (%):** Fruit set per shoot was calculated using the following formula:

$$\text{Fruit Set (\%)} = \frac{\text{Total number of fruits set per shoot}}{\text{Total number of flowers per shoot}} X\ 100$$

- **Yield:** Harvesting was carried out in June-July 2025. The total fruits per plant and the yield per plant (kg) were recorded at harvest. The total yield per hectare (t/ha) was calculated based on the total number of plants per hectare.

2.6 Fruit Quality Evaluation:

Ten mature, healthy fruits from each cultivar were randomly selected and analyzed in the lab to assess fruit quality parameters.

Physical Traits: Fruit weight (g) was recorded using a digital weighing scale. The fruits were manually separated to obtain arils, and the aril weight (g) was measured with the same electronic scale. Juice recovery (%) was calculated by manually extracting juice from arils using a hand juicer, and the volume of juice was measured with a graduated cylinder.

- **Aril (%):** Calculated as:

$$\text{Aril (\%)} = \frac{\text{Total weight of arils (g)}}{\text{Total Fruit weight (g)}} X\ 100$$

- **Juice Recovery (%):** Calculated as:

$$\text{Juice Recovery (\%)} = \frac{\text{Weight of extracted juice (g)}}{\text{Total weight of arils (g)}} X\ 100$$

- **Titratable Acidity (%):** Determined by titrating a known volume of juice against 0.1N sodium

hydroxide (NaOH) using phenolphthalein as an internal indicator. The persistent light pink color identified the endpoint. AOAC (2005). The acidity was calculated using the following formula:

$$\text{Titratable Acidity (\%)} = \frac{\text{Titre value} \times \text{Normality of NaOH} \times \text{Equivalent weight of citric acid}}{\text{Volume of sample}} X\ 100$$

- **Biochemical Traits:** TSS (°Brix) was measured with a digital refractometer calibrated to 20°C. Total sugars (%) were estimated using the Lane and Eynon method, and the TSS/acid ratio was calculated. Ranganna (1986)

2.7 Statistical Analysis

The data were analyzed statistically using the Web-based Agricultural Statistics Software Package (WASP 2.0) developed by ICAR-CCARI, Goa. An Analysis of Variance (ANOVA) for a Randomized Block Design (RBD) was used to examine differences among cultivars. The Critical Difference (CD) at a 5% significance level ($P \leq 0.05$) and the Standard Error of the Mean (SEm ±) were calculated to evaluate treatment means.

III. RESULTS AND DISCUSSION

The performance of five commercial pomegranate cultivars differed markedly in vegetative growth, flowering patterns, yield characteristics, and fruit quality under the semi-arid conditions of Western Maharashtra. The analysis of variance showed statistically significant differences among cultivars for all traits studied, indicating a strong genotypic influence in moisture-limited environments (Babu et al., 2011; Prasad et al., 2003).

3.1 Vegetative Growth Performance

Vegetative parameters differed significantly among cultivars. Bhagwa recorded the greatest shoot length (32.10 cm), followed by Sharad King (31.45 cm) and Super Bhagwa (30.93 cm), while the traditional cultivar Ganesh had the shortest shoot length (28.38 cm). Similarly, the number of leaves per shoot was highest in Bhagwa (62.40), indicating greater vegetative vigor. Total leaf area per shoot also followed this trend, with Bhagwa measuring 655.20 cm² compared to 465.32 cm² in Ganesh (Table no. 1, Fig 1).

The higher vegetative growth in Bhagwa may be due to its improved genetic potential and better adaptation to semi-arid stress conditions (Marathe & Babu, 2015; Mane & Shinde, 2020). Increased leaf area enhances photosynthetic efficiency, supporting better reproductive development and yield (Chandra et al., 2010). Similar variations in vegetative vigor across cultivars have been documented in other fruit crops under semi-arid conditions. For instance, in Guava (*Psidium guajava* L.), significant genotypic differences in plant height and canopy spread were observed across 18 genotypes, with superior vegetative growth directly correlating with higher fruit yield (Yadav et al., 2022). Likewise, studies on Ber (*Ziziphus mauritiana* Lamk.) revealed that cultivars such as 'Karela' and 'Delhi White' exhibited higher leaf area and shoot vigor than others, suggesting that genetic makeup plays a primary role in resource acquisition under abiotic stress (Bhatti et al., 2021). These findings reinforce the importance of selecting vigorous genotypes for sustainable production in arid ecosystems.

Table 1: Vegetative Growth Parameters of Pomegranate Cultivars

Cultivar	Length of New Shoot (cm)	No. of Leaves per Shoot	Total Leaf Area per Shoot (cm²)
Super Bhagwa	30.93	59.36	630.97
Bhagwa	32.1	62.4	655.2
Solapur Lal	29.5	56.8	590.4
Sharad King	31.45	60.15	642.3
Ganesh (Control)	28.38	43.76	465.32
SE m (±)	0.85	1.2	12.45
CD (5%)	2.54	3.58	36.12
CV (%)	5.2	4.8	6.15

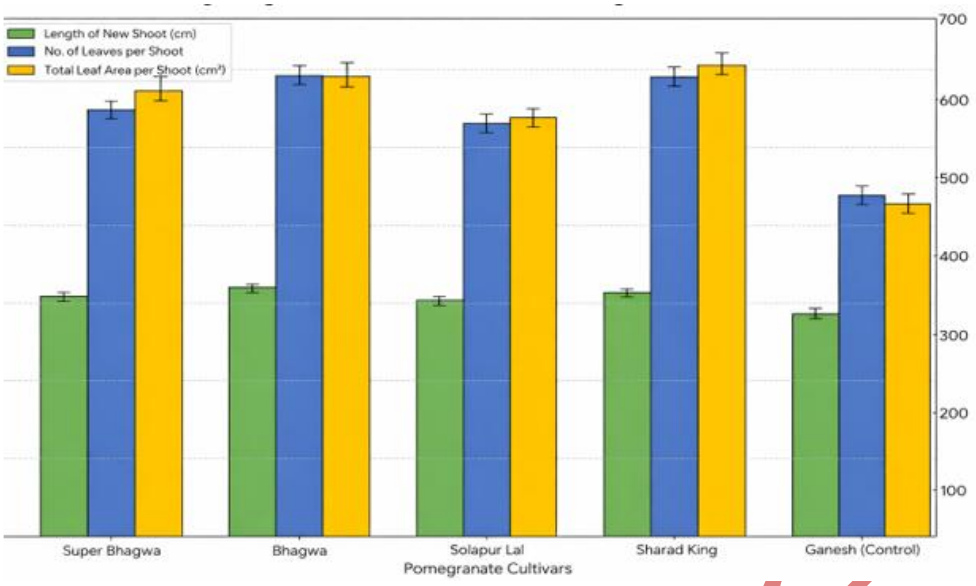

Fig 1. Comparative analysis of shoot length among pomegranate cultivars.

3.2 Flowering Behavior

Flowering dynamics significantly influenced yield performance. Bhagwa recorded the highest number of hermaphrodite flowers per shoot (20.15), closely followed by Sharad King (19.80) and Solapur Lal (19.50) (Shilpa et al., 2024). In contrast, Ganesh produced a comparatively higher number of male flowers (15.60) and fewer hermaphrodite flowers (14.30), which negatively affected fruit set. The fruit set per shoot was maximum in Bhagwa (10.80) and Sharad King (10.10), while Ganesh showed the lowest fruit set (7.20). Similarly, fruit retention per shoot was significantly higher in Super Bhagwa (7.45) compared to Ganesh (4.90). (Table no. 2, Fig 2). Since only hermaphrodite flowers develop into fruits, a higher proportion of hermaphrodite flowers directly contributed to increased yield potential in improved cultivars (Nimbalkar et al., 2017). The superior flowering efficiency of Bhagwa and Sharad King was noted, indicating better physiological stability and reproductive adaptability under semi-arid conditions (Shilpa et al., 2024).

Similar results regarding flowering phenology have been reported in other fruit species. In Acid Lime (*Citrus aurantifolia* Swingle), researchers found that different genotypes exhibited a wide range of flowering durations and flower types, where cultivars with a higher percentage of perfect flowers significantly out-yielded those with more staminate flowers (Desai et al., 2023). Furthermore, studies in Mango (*Mangifera indica* L.) have demonstrated that cultivars such as 'Amrapali' exhibit higher flowering intensity and lower sex ratios (more hermaphrodite flowers) than traditional varieties, suggesting a similar genetic advantage in reproductive efficiency under tropical stress (Reddy & Kurian, 2022).

Table 2: Flowering and Fruiting Behaviour of Pomegranate Cultivars

Cultivar	Male Flowers / Shoot	Hermaphrodite Flowers / Shoot	Fruits Set / Shoot	Fruits Retained / Shoot
Super Bhagwa	12.45	18.2	9.35	6.1
Bhagwa	11.9	20.15	10.8	7.45
Solapur Lal	13.1	19.5	9.85	6.8
Sharad King	12.05	19.8	10.1	7.2
Ganesh (Control)	15.6	14.3	7.2	4.9
SE m (±)	0.42	0.58	0.31	0.22
CD (5%)	1.25	1.72	0.92	0.65
CV (%)	6.12	5.85	7.3	6.95

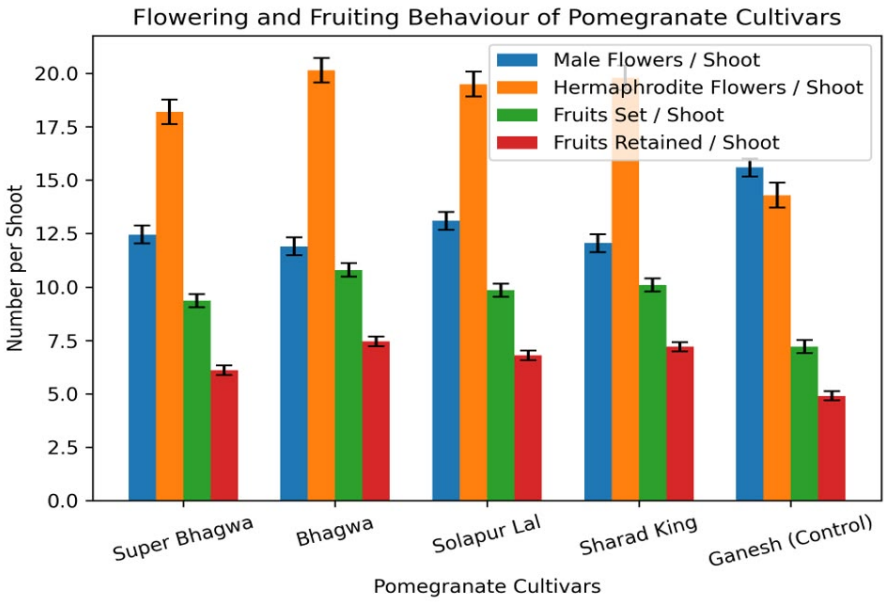

Fig. 2: Flowering behavior (Male vs. Hermaphrodite flowers) of selected cultivars.

3.3 Yield and Yield Attributes

Yield parameters showed highly significant differences among cultivars. Bhagwa recorded the highest number of fruits per plant (82.20) and the maximum yield per plant (25.10 kg), resulting in the highest estimated yield for Bhagwa (18.57 t/ha). Sharad King ranked second with 18.01 t/ha, followed by Super Bhagwa (16.58 t/ha) and Solapur Lal (16.13 t/ha) (Mane & Shinde, 2020; Shinde et al., 2018). Ganesh recorded the lowest yield (12.21 t/ha) (Table no. 3, Fig 3).

The higher yield in Bhagwa can be attributed to its superior vegetative growth, higher hermaphrodite flower production, better fruit retention, and increased fruit weight. Yield in pomegranate under semi-arid conditions is largely dependent on the cultivar's ability to balance vegetative and reproductive growth under limited water availability. The traditional cultivar Ganesh showed reduced performance, indicating comparatively lower adaptability to current climatic stresses (Babu et al., 2011).

These findings are consistent with recent multi-location trials in similar agro-climatic zones. For instance, (Jadhav et al., 2023) evaluated pomegranate genotypes on the Deccan Plateau and found that ' Bhagwa' consistently outperformed 'Ganesh' and 'Mridula' in fruit retention and total biomass accumulation, attributing this to a more robust root system and higher water-use efficiency (WUE). Similarly, Gaikwad and Patil (2022) reported that the yield gap between traditional and improved cultivars like 'Solapur Lal' and ' Bhagwa' widens under high-temperature stress during the *mrig bahar* flowering season, as improved selections exhibit significantly lower flower drop and better pollen viability. These results reinforce the conclusion that genetic improvement in pomegranate has successfully targeted physiological resilience alongside raw yield potential, making newer cultivars more suitable for the evolving semi-arid landscape of Western Maharashtra.

Table 3: Yield Performance of Pomegranate Cultivars

Cultivar	Fruits / Plant	Yield / Plant (kg)	Estimated Yield (t/ha)
Super Bhagwa	78.5	22.4	16.58
Bhagwa	82.2	25.1	18.57
Solapur Lal	75.15	21.8	16.13
Sharad King	80.4	24.35	18.01
Ganesh (Control)	65.3	16.5	12.21
SE m (±)	1.45	0.55	0.48
CD (5%)	4.32	1.64	1.43
CV (%)	5.1	6.25	6.4

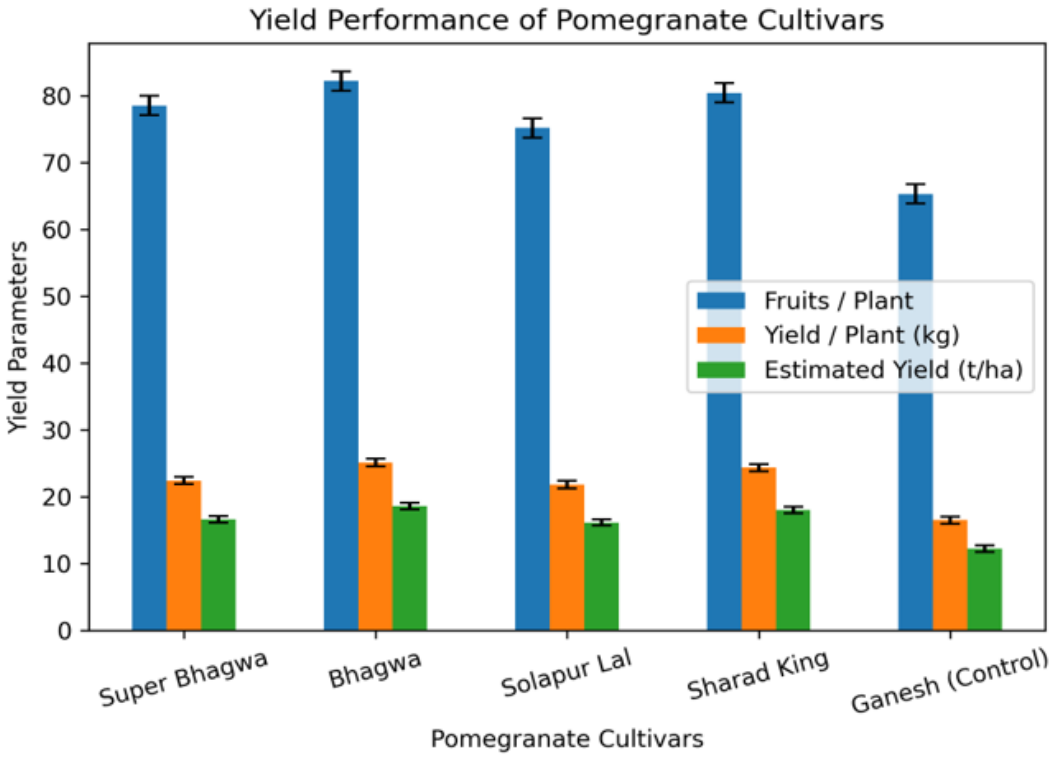

Fig. 3: Estimated yield (t/ha) of pomegranate cultivars under semi-arid conditions.

3.3.1 Observations on Disease Incidence

- The field evaluation included monitoring for Bacterial Blight (*Xanthomonas axonopodis* pv. punicae), which is a major constraint in the region.
- Bhagwa and Solapur Lal showed lower disease incidence on foliage and fruits compared to the control.
- Solapur Lal, specifically bred for high performance, exhibited minimal leaf spot development. (Babu et al., 2011).
- The traditional cultivar Ganesh was found to be the most susceptible to climatic and biotic stresses under the experimental conditions.

3.4 Fruit Physical and Quality Parameters

Significant differences were observed in fruit physical and biochemical attributes (Table 4). Bhagwa produced the heaviest fruits (315.60 g) and the highest aril weight (205.80 g), along with superior juice recovery (51.20%). Sharad King also performed well in fruit weight (305.20 g) and juice recovery (50.40%) (Shilpa et al., 2024). Solapur Lal excelled in chemical quality, recording the highest Total Soluble Solids (16.50 °Brix), followed closely by Bhagwa (16.20 °Brix) (Babu et al., 2011). The control cultivar Ganesh recorded comparatively lower fruit weight (252.10 g), juice recovery (44.10%), and TSS (15.10 °Brix). (Table no. 4, Fig 4 and Fig. 5). Higher TSS values indicate increased sweetness and consumer acceptance, while greater juice recovery enhances processing suitability (Pareek et al., 2015; Tehranifar et al., 2010). The improved fruit quality in Bhagwa and Solapur Lal indicates advancements in genetic improvement aimed at meeting export standards and market demand (Mane & Shinde, 2020).

Similar findings of superior biochemical profiles in improved cultivars have been observed in other recent pomegranate studies. For example, Thorat et al. (2023) evaluated promising pomegranate hybrids in Western India. They noted that selections like 'Solapur Lal' consistently maintain higher TSS and lower acidity compared to 'Ganesh' under high-temperature stress, which they attributed to efficient sugar-acid metabolism and pigment stability. Additionally, More and Deshmukh (2022) reported that juice recovery percentages in 'Bhagwa' were significantly higher than in traditional varieties due to a lower rind-to-aril ratio and larger juice vesicles. Studies in other Mediterranean-type fruit crops support these results; for instance, in Fig (*Ficus carica* L.), newer selections for semi-arid zones have shown a 15-20% increase in TSS over indigenous landraces, highlighting a broad trend where modern breeding successfully bridges the gap between environmental resilience and high-quality consumer produce (Rao et al., 2024).

Table 4: Fruit physical and quality parameters

Cultivar	Fruit Weight (g)	Aril Weight (g)	100 Aril Weight (g)	Juice Recovery (%)	TSS (°Brix)	Total Sugars (%)
Super Bhagwa	285.4	182.5	32.1	48.5	15.8	13.2
Bhagwa	315.6	205.8	34.5	51.2	16.2	14.1
Solapur Lal	290.15	188.4	31.8	49.3	16.5	13.8
Sharad King	305.2	198.6	33.7	50.4	15.95	13.5
Ganesh (Control)	252.1	155.3	28.5	44.1	15.1	12.8
SE m (±)	5.24	3.85	0.65	0.95	0.28	0.22
CD (5%)	15.42	11.32	1.91	2.78	0.82	0.64
CV (%)	4.85	5.2	5.4	4.15	3.9	4.1

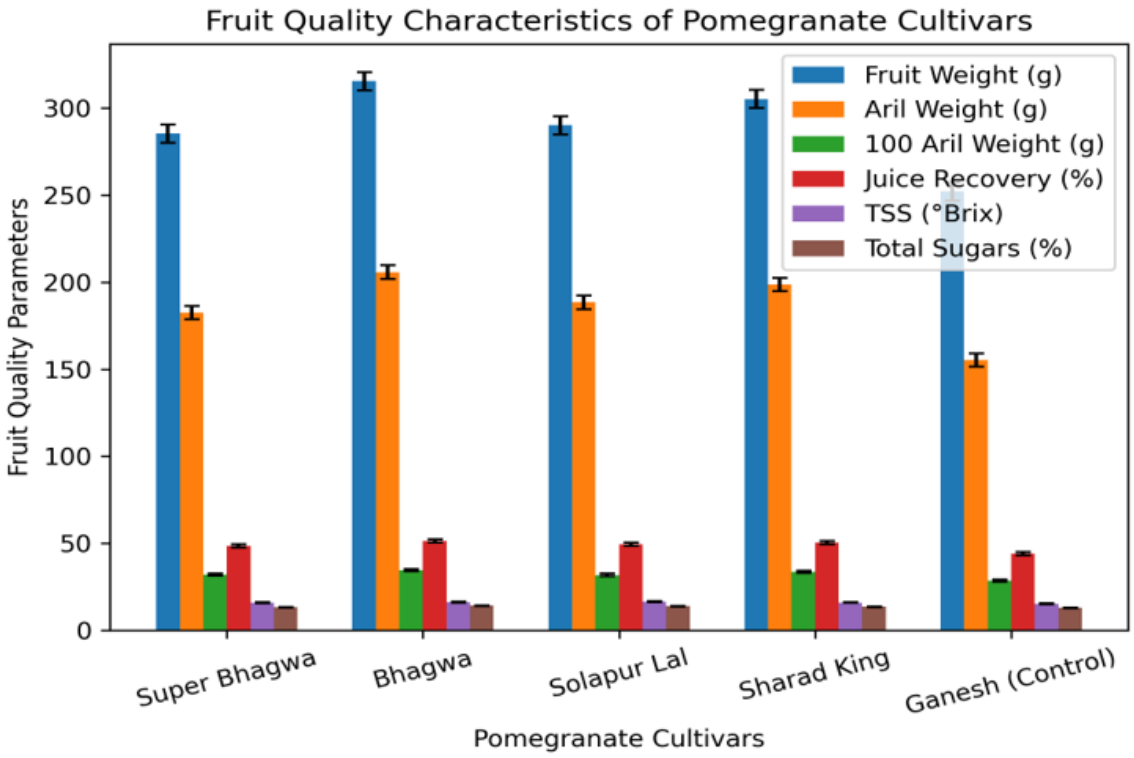

Fig. 4: Comparison of fruit weight (g) among commercial pomegranate cultivars.

3.5 Yield and Economic Impact

Yield performance is the key indicator of commercial success in pomegranate cultivation (Sheikh, 2006). In this study, Bhagwa achieved the highest estimated yield of 18.57 t/ha, significantly surpassing Ganesh, which recorded 12.21 t/ha. The superior performance of improved cultivars over traditional varieties under semi-arid conditions has also been documented in regional evaluations (Mane & Shinde, 2020; Shinde et al., 2018).

The financial return from pomegranate cultivation is directly impacted by yield potential and current market prices. Recent horticultural statistics show that the adoption of improved cultivars greatly increases farmers' earnings in semi-arid areas (Horticulture Statistics Division, 2021; NHB, 2023). With an average market price of ₹80 per kg for export-quality fruits, Bhagwa can potentially generate a gross income of around ₹14,85,600 per hectare. In comparison, Ganesh yields about ₹9,76,800 per hectare, offering an additional income of nearly ₹5,08,800 per hectare by choosing Bhagwa.

Furthermore, the higher fruit weight of Bhagwa (315.60 g) improves its export potential and grading advantage over Ganesh (252.10 g). Fruit size, weight, and overall quality remain the most important factors influencing international market acceptance, consumer preference, and grower profitability in the current pomegranate trade. Recent studies highlight that improved cultivars with better physical traits not only command higher market prices but also show greater resilience during long-distance transport, which is crucial for export-oriented cultivation (Varpe et al., 2025). These findings support recommendations for adopting high-yielding, heavy-fruiting varieties in semi-arid regions to maximize economic benefits. They also endorse cultivar replacement strategies to enhance economic sustainability in semi-arid pomegranate production systems (ICAR-NRCP, 2024).

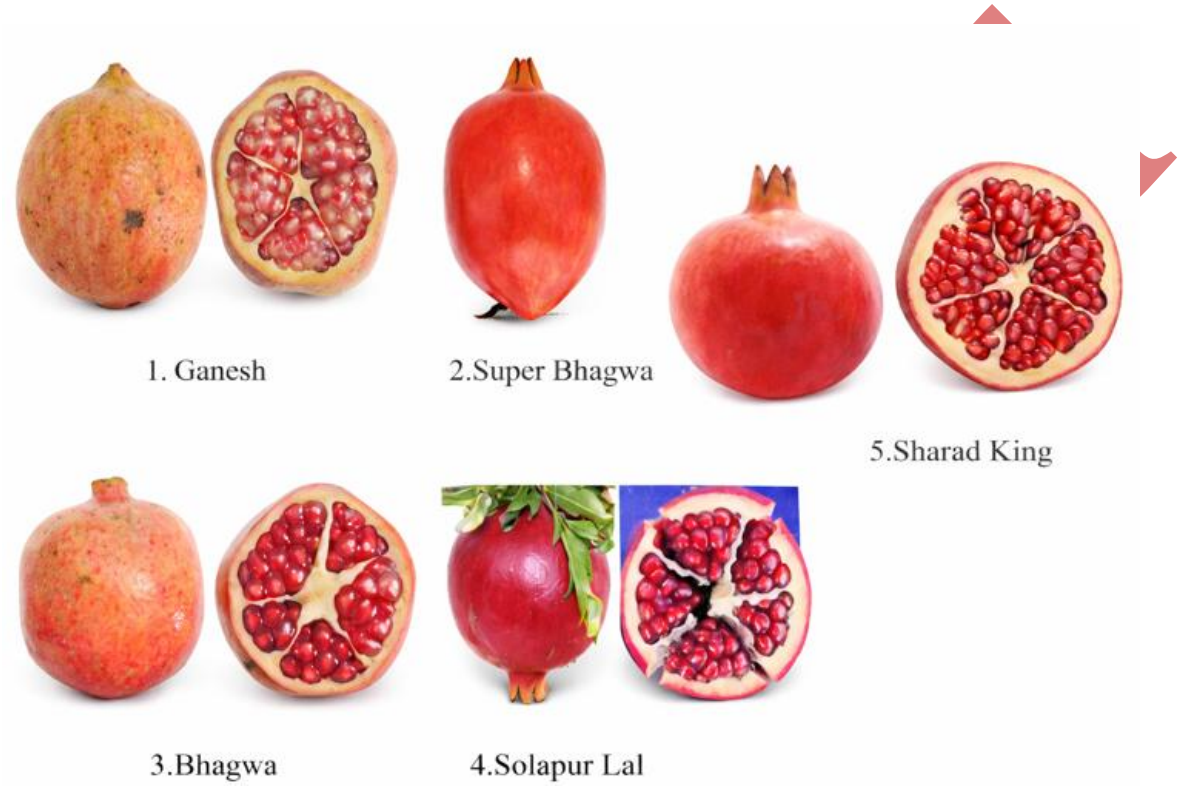

Fig. 5. Morphological comparison of major commercial pomegranate cultivars evaluated under semi-arid conditions. (1) Ganesh, (2) super Bhagwa, (3) Bhagwa, (4) Solapur Lal, and (5) Sharad king showing external fruit appearance and internal aril characteristics.

IV. CONCLUSION

A comparative evaluation clearly indicates that the Improved cultivars, such as Bhagwa and Solapur Lal, demonstrated superior adaptability to semi-arid agro-climatic conditions of Western Maharashtra than the traditional Ganesh variety. Based on a comprehensive analysis of growth, yield, and quality parameters, the following conclusions are drawn:

Bhagwa is the top-recommended cultivar for commercial growers aiming for maximum yield (18.57 t/ha) and large fruit size (315.60 g). Its higher fruit weight and yield potential can increase farmer profits by over 40–50% per hectare compared to traditional cultivars. Fruit quality parameters, such as total soluble solids, acidity, and aril characteristics, are key factors influencing consumer acceptance of pomegranates (Chater et al., 2023).

- Sharad King is a strong alternative, with a high yield (18.01 t/ha) and excellent fruit retention (Shilpa et al., 2024).
- Solapur Lal is highly suitable for farmers and the processing industry, emphasizing juice quality, antioxidant content, and sweetness (16.50 °Brix) (Babu et al., 2011).
- The study also indicates that newer cultivars, such as Bhagwa and Solapur Lal, show improved field tolerance to biotic stresses, ensuring more consistent returns (NRCP Annual Report 2023).

Overall, the strategic adoption of Bhagwa and Solapur Lal can significantly enhance the productivity, export potential, and profitability of pomegranate farming in Maharashtra's semiarid regions (Varpe et al., 2025).

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CONFLICT OF INTEREST

The authors state that there is no conflict of interest related to the publication of this research manuscript.

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