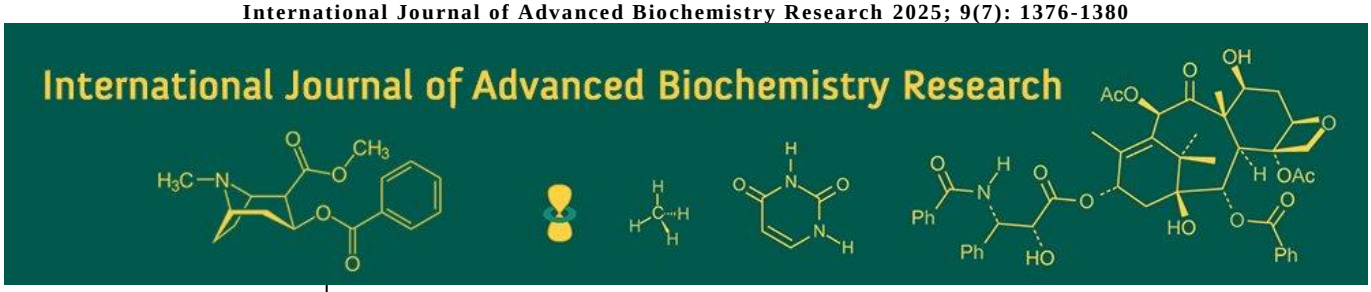

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Comparative analysis of quality characters and seed content of pink and white fleshed guava cultivars grown in rainy season

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Abstract
Guava is known for its exceptional nutritional value and year-round fruiting ability, although its qualitative traits vary depending on the cultivar and season of production. In this study, four rainy season grown guava cultivars *i.e*., Hisar Safeda, Shweta (white flesh), and Lalit, Punjab Pink (pink flesh) are analyzed for their physico-chemical characteristics, enzymatic activity, and seed content. The cultivars showed significant differences in total soluble solids (TSS), acidity, ascorbic acid, sugar:acid ratio, antioxidant activity, pectin content, and pectin methylesterase (PME) activity. Shweta recorded the highest TSS (12.07 °Brix), antioxidant activity (8.16 µmol Trolox/g FW), ascorbic acid content (129.51 mg/100 g FW), and sugar: acid ratio (32.89), whereas Lalit displayed the highest seed content (2.94%). Punjab Pink had moderate PME activity and recorded the highest pectin content (0.817%). This comparative study offers valuable information for choosing varieties for both fresh consumption and processing during the rainy season.

Keywords: Guava, physico-chemical quality, rainy season, pectin, PME, seed content

1. Introduction
Guava (*Psidium guajava* L.) is a nutrient dense tropical fruit prized for its adaptability, affordability, and suitability for fresh consumption as well as processing. Its ability to flourish in both summer and rainy seasons makes it an important commercial crop in India. In addition to being a good source of pectin, total phenols, and antioxidants (Fischer and Melgarejo, 2021) [8], it has four times higher amount of vitamin C found in oranges (Gangappa *et al*., 2022) [9]. The sweetness, acidity, firmness, and vitamin content of guava fruits vary seasonally due to agroclimatic conditions and cultivar-specific genetic potential (George and Thangasamy, 2025) [10]. White and pink fleshed guava cultivars vary substantially in their quality attributes, antioxidant capacity, and seed content (Dubey *et al*., 2016) [7].
It is imperative to comprehend these differences during the rainy season, as high humidity and fluctuating temperatures during this period impact fruit development and quality traits. Despite the quality of winter grown guava fruit has been documented in a several studies (Kumar *et al*., 2021; Chandana *et al*., 2025) [14, 5], limited data is available on comparative performance of white and pink cultivars that concentrate on both biochemical and seed characteristics under rainy conditions. This study attempts to bridge this narrow gap by analyzing the physico-chemical quality, antioxidant potential, firmness, seed percentage, and related enzymatic activity of four guava cultivars Hisar Safeda, Shweta (white), and Lalit, Punjab Pink (pink) grown under rainy season conditions.

2. Materials and Methods
2.1 Fruit Material
Fruits of Hisar Safeda, Shweta, Lalit, and Punjab Pink guava cultivars were harvested at full maturity during rainy season from orchard of Division of Fruits and Horticultural Technology, IARI, New Delhi-12 and transferred to laboratory of Division of Food Science and Postharvest Technology, IARI, New Delhi for further studies. Guava fruits of uniform. size were sorted, washed and were utilized for the execution of this present research work.

2.2 Fruit Sampling
Five different plants of each cultivar were randomly selected and ten fruits from those plants were used to analyze the fruit firmness individually. Later, to analyze physico-chemical parameters and enzyme activity, pulp from those fruits of each plant from 4 different cultivars was extracted separately (Fig. 1) and homogenized to carry out further analysis.

2.3 Observations recorded
2.3.1 Physico-Chemical parameters
Fruit firmness in the guava was recorded by using a texture analyzer (model: TA+Di, Stable micro systems, UK) using compression test (Jha *et al*., 2010) [13]. Maximum force in the force deformation curve was observed as firmness and is expressed in terms of Newton (N). Quality attributes, including total soluble solids (°Brix), total sugars (%), titratable acidity (%), and ascorbic acid (mg/100 g), were analyzed using the standard methods of analysis (AOAC, 1995) [3] by using homogenized fruit pulp. Further, TSS and titratable acidity were used to estimate sugar:acid ratio by employing following formula (Badal and Tripathi, 2021) [4].

$$\text{Sugar: Acid} = \frac{\text{Total Soluble solids (TSS)}}{\text{Titratable Acidity (TA)}}$$

Total phenols were estimated according to procedure standardized by Singleton and Rossi (1965) [19] and expressed as mg of gallic acid equivalents (GAE), and antioxidant capacity/Cupric Reducing Antioxidant Capacity (CUPRAC) is analyzed and expressed as µmol Trolox/g fresh fruit pulp (Apak *et al*., 2004) [2]. Pectin content of guava fruits was estimated by the gravimetric method (Ranganna *et al*., 2007) [16] and expressed as% calcium pectate. Pectin methyl esterase (PME) activity in guava fruits was analyzed by the method given by Hagerman and Austin (1986) [12] and expressed as µmol galacturonic acid/min/g fresh pulp of guava fruit.

2.3.2 Seed percentage
One-kilogram of over-ripe guava fruits from 5 different plants of each cultivar were randomly collected from the orchard. The seeds from each replication were extracted separately and seed percentage was determined by using following formula (Sahoo *et al*., 2017) [18].

$$\text{Seed percentage} = \frac{\text{Weight of seed present in sample}}{\text{Total fruit weight}} \times 100$$

2.3.3 Statistical analysis
The data recorded were subjected to ANOVA in Randomized Block Design (RBD). Analysis was done with 5% level of significance (p=0.05) using online statistical software GRAPES (Gopinath *et al*., 2021) [11].

3. Results
3.1 Physico-Chemical Quality Attributes
The quality attributes of the four cultivars varied significantly (Table 1). Among the white fleshed cultivars, Shweta had the highest total sugar (8.84%), TSS (12.07°Brix), and lowest acidity (0.37%). Shweta also had the highest ascorbic acid content (129.51 mg/100 g FW), indicating superior nutritional value. Significant variation was seen in the sugar acid ratios, with Shweta once again dominating (32.89), indicating its better taste quality. The peak antioxidant activity was recorded in Shweta (8.16 µmol Trolox/g FW), followed by Hisar Safeda (9.36 µmol Trolox/g FW). Punjab Pink had the lowest antioxidant activity of 5.33 µmol Trolox/g FW and Hisar Safeda recorded the lowest total phenols of 163.49 mg GAE/100 g FW.

Fruit firmness had showed a significant variation among the white and pink fleshed varieties. It was highest in Hisar Safeda (16.38 N), followed by Lalit (16.28 N) and Shweta (15.69 N), indicating better fruit texture in white cultivars. Punjab Pink was the softest (14.38 N). Among pink fleshed cultivars, Lalit had slightly lower TSS (10.43 °Brix) and acidity (0.70%) but had a higher phenol content (169.34 mg GAE/100 g FW). Punjab Pink had the lowest total sugar content (7.34%) and antioxidant activity (5.33 µmol Trolox/g FW), and recorded the highest acidity (0.79%).

3.2 Pectin and PME Activity
Punjab Pink had the highest pectin content (0.817%), indicating superior gelling properties, while Shweta had the lowest (0.71%) (Fig.2). Hisar safeda which recorded significantly higher PME activity (0.011 µmol/min/g FW), had the moderate pectin content of 0.75%. As Shweta recorded the lower in PME activity (0.0074 µmol/min/g FW), maintained acceptable texture. Lalit and Punjab Pink exhibited lower PME activity (0.009 and 0.008 µmol/min/g FW, respectively), correlating with lower pectin breakdown.

3.3 Seed Percentage
Seed content among these guava cultivars varied significantly (Fig. 3). Highest seed percentage of 2.94% was recorded in Lalit, followed by Shweta (2.65%) and Punjab Pink (2.57%). Hisar Safeda had comparatively lower seed percentage (2.05%), making it more desirable for table consumption.

4. Discussion
Seasonal impact on guava quality traits is well documented, with rainy season fruits often exhibiting altered sugar-acid balance, ascorbic acid content and antioxidant activity (Usman *et al*., 2021) [20]. Shweta emerged as the best cultivar in terms of sweetness and ascorbic acid content, which is consistent with previous findings of rainy season grown guava fruits (Sahoo *et al*., 2017) [18]. Its reduced PME activity suggests better firmness retention, which is beneficial for both fresh consumption and minimal processing (Ali *et al*., 2004) [1]. An excellent sugar:acid ratio of Shweta makes it ideal for potential processing applications (Dolkar *et al*., 2017) [6]. Hisar Safeda, which is not as sweet as Shweta, had a moderate pectin content and lower seed content, suggesting its better textural properties and processing suitability.

The PME enzyme activity further explain textural variance (Sachin *et al*., 2022) [17] among these guava cultivars. Among pink fleshed cultivars, Lalit had high seed content and low acidity, while Punjab Pinks' high pectin content and moderate PME activity make it valuable for jam and jelly production. Seed content, a key factor in determining consumer acceptance (Rajan *et al*., 2008) [15], was lower in white cultivars, giving them competitive advantage for table purposes. PME and pectin trends resembled the expected behavior of the guava cultivars in humid conditions.

Table 1: Physico-chemical qualities of rainy season guava fruits of different cultivars

Pulp colour	Variety	TSS (°Brix)	Total sugar (%)	Acidity (%)	Ascorbic acid (mg/100 g FW)	Sugar: Acid	Total phenols (mg GAE/100 g FW)	Antioxidant activity (µmol Trolox/g FW)	Fruit firmness (N)
Pink	Hisar Safeda	10.54b±0.05	8.10b±0.06	0.52c±0.03	113.42c±0.11	20.31b±0.92	163.49d±0.05	6.14b±0.13	16.38a±0.49
	Shweta	12.07a±0.32	8.84a±0.13	0.37d±0.02	129.51a±0.53	32.89a±0.70	165.48c±0.42	8.16a±0.07	15.69b±0.34
White	Lalit	10.43b±0.14	8.15b±0.10	0.70b±0.02	118.90b±0.38	14.87c±0.55	169.34a±0.21	5.40c±0.01	16.28ab±0.11
	Punjab Pink	10.49b±0.11	7.34c±0.02	0.79a±0.01	113.41c±0.21	13.33d±0.07	167.73b±0.25	5.33c±0.03	14.38c±0.40

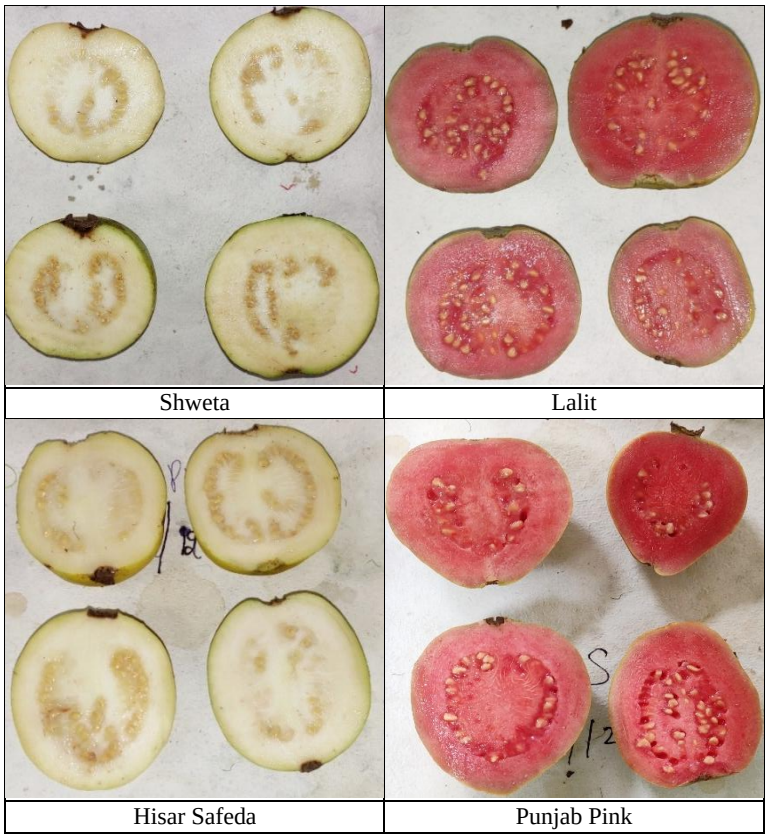

Fig 1: White and pink fleshed rainy season guava of different cultiva

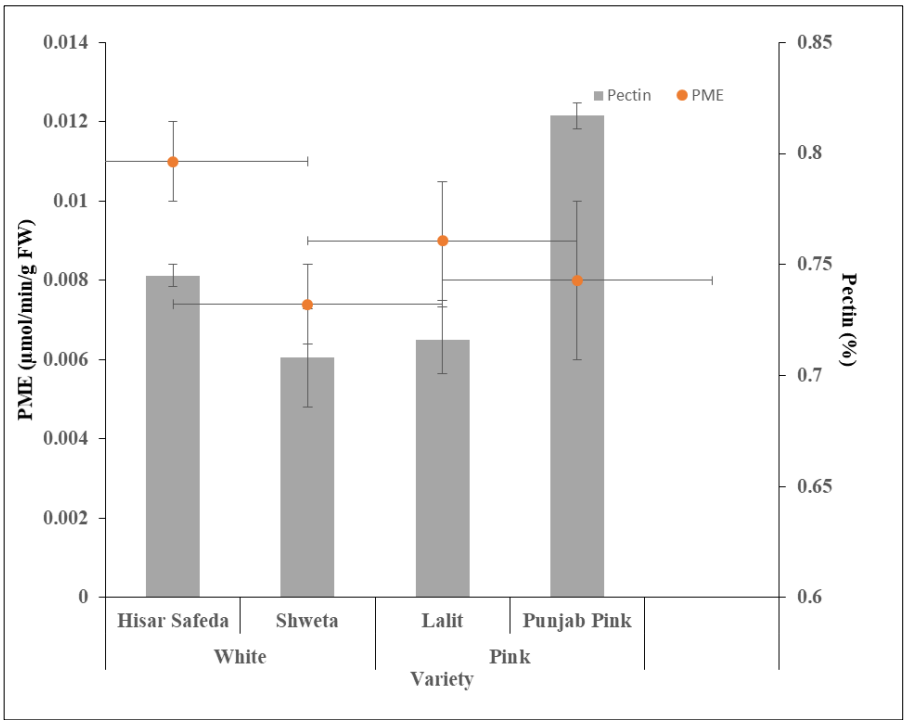

Fig 2: Pectin and PME content of rainy season guava fruits of different cultivars

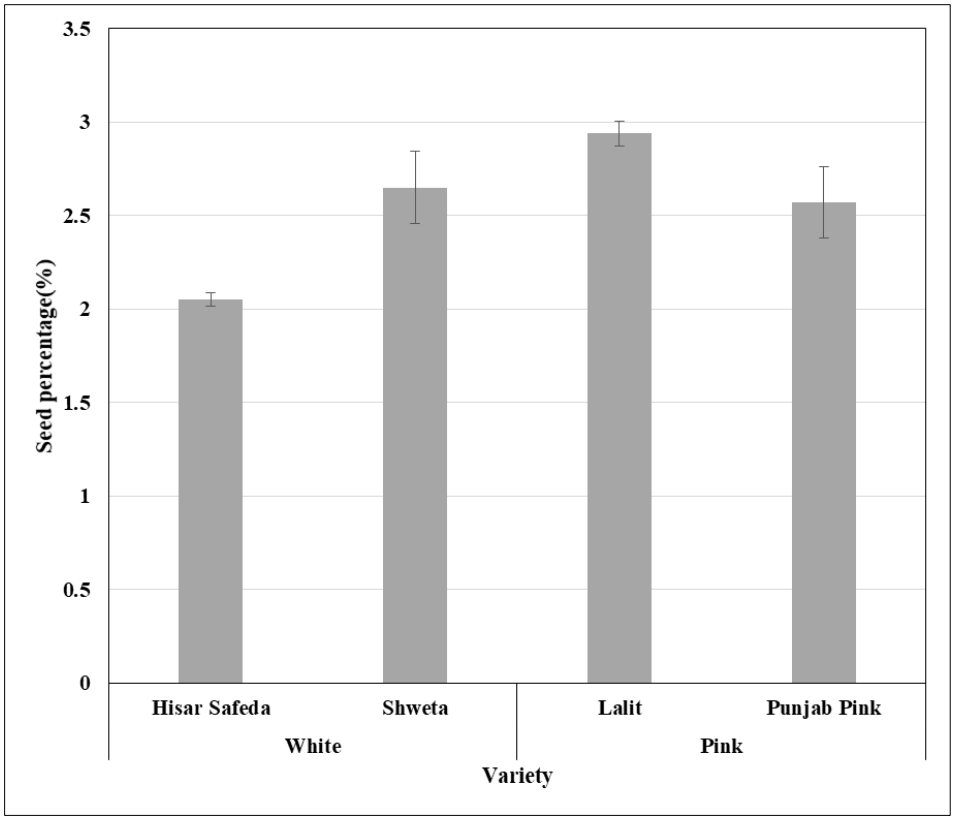

Fig 3: Seed percentage of rainy season guava fruits of different cultivars

5. Conclusion

This study presents a comparative assessment of rainy season grown white and pink fleshed four guava cultivars, highlighting significant differences in quality, antioxidant capacity, enzymatic activity, and seed percentage. Shweta emerged as the better performing cultivar with an exceptional sweetness, nutritional value, and reasonable seed content, suitable for both fresh use and processing. Lalit and Punjab Pink, despite of having higher seed content, shown promise for their pectin and total phenol richness. Hisar Safeda and Punjab Pink showed promising attributes for processing, whereas Lalit might be reserved for juice based applications because of its high seed load. These findings validate cultivar specific guidance for growers, fresh market and processors seeking for optimal usage during the rainy season.

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7. References

1. Ali ZM, Chin LH, Lazan H. A comparative study on wall degrading enzymes, pectin modifications and softening during ripening of selected tropical fruits. Plant Science. 2004;167(2):317-327. https://doi.org/10.1016/j.plantsci.2004.03.030
2. Apak R, Güçlü K, Özyürek M, Karademir SE. Novel total antioxidant capacity index for dietary polyphenols and vitamins C and E, using their cupric ion reducing capability in the presence of neocuproine: CUPRAC method. J Agric Food Chem. 2004;52(26):7970-7981. https://doi.org/10.1021/jf048741x
3. Association of the Official Analytical Chemists (AOAC). Official methods of analysis. 1995.
4. Badal DS, Tripathi VK. Effect of foliar application of NAA and Boron on physico-chemical parameters of winter season guava (*Psidium guajava* L.) cv. Lucknow-49. Pharma Innov J. 2021;10(9):928-932.
5. Chandana MR, Goswami AK, Rana VS, Kumar C, Singh SK, Goswami S, *et al*. Unravelling the physicochemical and antioxidant profiles of guava genotypes across developmental stages and seasonality. Food Biosci. 2025;107097. https://doi.org/10.1016/j.fbio.2025.107097
6. Dolkar D, Bakshi P, Gupta M, Wali VK, Kumar R, Hazarika TK, *et al*. Biochemical changes in guava (*Psidium guajava*) fruits during different stages of ripening. Indian J Agric Sci. 2017;87(2):257-260. https://doi.org/10.56093/ijas.v87i2.67659
7. Dubey MC, Kumar R, Kumar J, Kumar A. Morphological and physico-chemical characteristics of guava genotypes. Res Crops. 2016;17(2):276-282. https://doi.org/10.5958/2348-7542.2016.00047.4
8. Fischer G, Melgarejo L. Ecophysiological aspects of guava (*Psidium guajava* L.). A review. Rev Colomb Cienc Hortícol. 2021;15(2). https://doi.org/10.17584/rcch.2021v15i2.12355
9. Gangappa ND, Singh C, Verma MK, Thakre M, Sevanthi AM, Singh R, *et al*. Assessing the genetic diversity of guava germplasm characterized by morpho-biochemical traits. Front Nutr. 2022;9:1017680. https://doi.org/10.3389/fnut.2022.1017680
10. George AR, Thangasamy K. *Psidium guajava* L. (Poor Man's Fruit). Pomotherapeutic Insights on Wild Edible Fruits. 2025:191.

11. Gopinath PP, Parsad R, Joseph B, VS A. grapesAgri1: collection of shiny apps for data analysis in agriculture. J Open Source Softw. 2021;6(63):3437. https://doi.org/10.21105/joss.03437
12. Hagerman AE, Austin PJ. Continuous spectrophotometric assay for plant pectin methyl esterase. J Agric Food Chem. 1986;34(3):440-444. https://doi.org/10.1021/jf00069a015
13. Jha SK, Sethi S, Srivastav M, Dubey AK, Sharma RR, Samuel DV, *et al*. Firmness characteristics of mango hybrids under ambient storage. J Food Eng. 2010;97(2):208-212. https://doi.org/10.1016/j.jfoodeng.2009.10.011
14. Kumar A, Bhuj BD, Ram S, Singh CP, Dhar S, Yadav RK. Crop regulation in fruit crops: a review. Ann Rom Soc Cell Biol. 2021;25(6):7896-7919.
15. Rajan S, Yadava LP, Kumar R, Saxena SK. Direct and indirect effects of seed related characters on number of seed in guava (*Psidium guajava* L.) fruits. Sci Hortic. 2008;116(1):47-51.
16. Ranganna K, Mathew OP, Yatsu FM, Yousefipour Z, Hayes BE, Milton SG. Involvement of glutathione/glutathione S-transferase antioxidant system in butyrate-inhibited vascular smooth muscle cell proliferation. FEBS J. 2007;274(22):5962-5978. https://doi.org/10.1111/j.1742-4658.2007.06119.x
17. Sachin AJ, Rao DS, Ravishankar K, Ranjitha K, Vasugi C, Narayana CK, *et al*. 1-MCP treatment modulated physiological, biochemical and gene expression activities of guava during low-temperature storage. Acta Physiol Plant. 2022;44(12):125. https://doi.org/10.1007/s11738-022-03463-x
18. Sahoo J, Tarai RK, Swain SC, Sethy BK, Dash D. Physico-chemical analysis of some guava genotypes during rainy and winter season under east and south east coastal plain zone of Odisha. Int J Chem Stud. 2017;5(6):527-531.
19. Singleton VL, Rossi JA. Colorimetry of total phenolics with phosphomolybdic-phosphotungstic acid reagents. Am J Enol Vitic. 1965;16(3):144-158. https://doi.org/10.5344/ajev.1965.16.3.144
20. Usman M, Shah MH, Fatima B, Ahmad Z. Genotypic and seasonal variability in guava fruit quality and implications for breeding. Pak J Agric Sci. 2021;58(3). https://doi.org/10.21162/PAKJAS/21.9915