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EFFECT OF POST-HARVEST TREATMENTS ON QUALITY AND SHELF LIFE OF RAINY SEASON GUAVA (*PSIDIUM GUAJAVA* L.) CV. HISAR SAFEDA AND VNR-BIHI

Preeti Jha*, Satpal Baloda and Mihretu Yonas Barkessa
Department of Horticulture, Chaudhary Charan Singh Haryana Agricultural University, Hisar–125004, Haryana, India
*Corresponding author E-mail: preetijha1910@gmail.com
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ABSTRACT

The present study was conducted in the Department of Horticulture, CCS Haryana Agricultural University, Hisar, to evaluate the effect of post-harvest treatments on quality and shelf life of rainy season guava (*Psidium guajava* L.), cultivars Hisar safeda and VNR bihi. The experiment involved analyzing fruit samples every two days interval for up to 8 days under ambient storage conditions. All treatments were effective in extending the shelf life compared to the control. During storage period, physiological loss in weight and decay loss increased, while fruit firmness, ascorbic acid, titrable acidity and pectin content decreased. Quality parameters such as total sugars, reducing sugars and total soluble solids (TSS) initially increased and then declined. The guava treated with gum acacia 25% showed a delayed overall decline in total soluble solids (10.22 ^{o}Brix and 9.90 ^{o}Brix), titratable acidity (0.41% and 0.39%), total sugar (6.61% and 5.84%) and physiological loss in weight (6.53% and 6.71%) in Hisar safeda and VNR bihi cultivars respectively. Similarly, calcium nitrate 3% was found to be effective in maintaining the fruit firmness (8.12 kg/cm^2 and 8.78 kg/cm^2), pectin (1.05% and 0.99%) and reduced decay loss (6.37% and 7.20%) whereas salicylic acid 150ppm was best for retaining ascorbic acid (156.74 mg/100g and 161.30 mg/100g pulp) level in both the cultivars. The highest qualitative parameters were recorded at day 4 of storage for both cultivars. The highest shelf life was found 7.2 days in Hisar safeda and 7.0 days in VNR bihi when treated with gum acacia. Overall, 25% gum acacia, followed by 3% calcium nitrate, proved most effective in maintaining post-harvest quality and extending the shelf life of rainy season guava cultivars under ambient conditions.

Keywords **:** Guava, gum acacia, calcium nitrate, salicylic acid, post-harvest, coating.

Introduction

The guava (*Psidium guajava* L.) belongs to the genus *Psidium* L. of the family Myrtaceae. The family Myrtaceae has 130 genera and nearly 6000 species (Vasugi *et al*., 2023). Its rich nutritional composition makes it essential for strengthening the immune system, supporting digestive health and countering oxidative stress (Parvez *et al*., 2018). Guava is widely planted in tropical areas, for a crucial food supply that supports local economies and provides farmers with money. Its adaptability, minimal environmental impact and potential for value-added goods emphasize its importance (Sethi *et al*., 2024). India leads worldwide guava production in 2024, with an annual output of 26.3 million metric tons. The leading guava-producing countries include Indonesia, India, China, Pakistan, Mexico. These nations dominate worldwide guava production because of their good weather conditions, huge planting areas and strong agricultural methods (FAO, 2024). Hisar safeda (HS) is becoming popular among guava cultivars. It is the hybrid created through cross-pollination between Allahabad Safeda and Seedless. VNR bihi (VNRB) is also recognized as a prominent guava variety in India from a commercial perspective, as its larger-sized fruits command higher prices. These cultivars are primarily cultivated from central to northern India.

Guava is a climacteric fruit with high moisture content, making it perishable due to its brittle peel and high polyphenol content (Shukla *et al*., 2021). Fruits

cultivated especially in the summer or rainy season have a relatively short shelf life due to increased pest and disease attack, faster ripening caused by high humidity and temperature and poorer fruit quality compared to winter season crop (Singh, 2011). There are various techniques for increasing the shelf life of guava. One of these is post-harvest treatment. The post-harvest dipping procedure enhances the shelf life of fruits by keeping them firm and suppressing rotting organisms (El-Beltagi *et al*., 2025). Recent trends also show use of bilayer coating including both the chemical and edible substances for creating a film around the fruits (Singh, 2024). Gum Arabica (GA) is a light-orange or pale-white water-soluble polysaccharide secreted from *Senegal* and *Seyal* species of *Acacia* trees in the family Fabaceae subfamily Caesalpinioideae that is mostly composed of D-galactose, L-arabinose, L-rhamnose and D-glucoronic acid, with a little amount of proteins or metal ions (Tahir *et al*., 2020). Because of its emulsification, water solubility, film formation and antioxidant activity, GA is widely utilized as a natural film preservative (Karaaslan *et al*., 2021). The Liliaceae family includes short-stemmed succulent plant species known as Aloe Vera (AV). Aloe vera gel has been utilized as an edible coating. This gel is tasteless, colorless and odorless. This natural product provides a safe and ecologically sustainable alternative (Hasan *et al*., 2021). Calcium is thought to be the most important mineral element in determining fruit quality (Singh, Bakshi *et al*., 2019). Ca^{2+} can interact directly with pectic acid in the fruit cell wall to generate calcium pectate, preventing the intracellular gel layer from disintegrating and preserving the fruit texture (Bhadaraka *et al*., 2022). Salicylic acid used after harvest affects the physicochemical characteristics of fruits and vegetables, particularly their physiologically active components (Supapvanich and Promyou, 2013). It has been shown to inhibit the conversion of ACC into ethylene by suppressing ACC oxidase activity (Singh, Singh, Prasad *et al*., 2019).

It has been seen that the studies on use of post-harvest coating on extending shelf life of winter season guava is prevalent however there is a little work done with respect to post- harvest treatments' effect on the rainy season guava of varieties Hisar safeda and VNR bihi. Keeping this in view, the following study was undertaken.

Materials and Methods

For the experimental study, uniform disease free and healthy fruits of V_1–Hisar safeda and V_2–VNR Bihi were selected for harvesting. The guava fruits were harvested by handpicking early in the morning at physiological maturity during 2nd week of August from the experimental orchard, CCS HAU, Hisar. Disease free and uniform sized fruit were collected in plastic crates and immediately brought to the laboratory. After washing and cleaning, the fruits were subjected to dip treatment with T_1 - control (untreated), T_2 - gum acacia 15%, T_3 - gum acacia 20%, T_4 - gum acacia 25%, T_5- 1% calcium nitrate, T_6 - 2% calcium nitrate, T_7 - 3% calcium nitrate, T_8 - salicylic acid 50 ppm, T_9- salicylic acid 100 ppm, T_{10} - salicylic acid 150 ppm, T_{11}- aloe vera gel 60%, T_{11}- aloe vera gel 80%, T_{11}-aloe vera gel 100% exact for 2 minutes. Then the fruits were packed in corrugated fiber board (CFB) boxes and stored at room temperature. The parameters were recorded on day 0 (S_1), day 2 (S_2), day 4 (S_3), day 6 (S_4) and day 8 (S_5) The study was carried out in the Post-harvest Laboratory of Department of Horticulture, CCS HAU, Hisar during the season 2024 -25. Total soluble solid was determined by using ERMA hand refractometer of the range of 0-32 ^{0}Brix. Titratable acidity was measured with the help of titration method given in A.O.A.C. (1990). The method used for the estimation of sugars was described by Hulme and Narain (1931). The method used for estimation ascorbic acid was mentioned in A.O.A.C. (1990). The Physiological loss of weight (PLW) of fruit was calculated on the basis of initial weight. Fruit weight was recorded at each storage interval and percent physiological loss in weight (PLW) was calculated by subtracting final weight from the initial weight of fruits. Decay loss (%) of fruits was decided on the basis of visual observations. Simply counting the number of spoiled fruits displaying fungal infection and subsequent rotting in a replication for the evaluation of decay loss and expressed in percentage. The number of days from date of harvested that fruit remains in acceptable conditions were recorded as the shelf -life. The stage where in more than 50 per cent of the stored fruits became unfit for consumption was considered as end of shelf life in particular treatment and expressed as mean number of days.

Results and Discussion

Total soluble solids (ºBrix): Treatments and storage time have a considerable impact on the guava's total soluble solids (TSS). Fruits treated with 25% gum acacia (T_4) – 10.22 ^{o}Brix in Hisar safeda & 9.90 ^{o}Brix in VNR bihi had the highest TSS. On the other hand, fruits under control treatment in the varieties Hisar safeda (9.87 ^{o}Brix) and VNR bihi (9.12 ^{o}Brix) had the lowest TSS. Regardless of treatment, the TSS level of guava fruit increased until the fourth day (9.45 °Brix to 10.53 °Brix) and then decreased over the course of the eight-day (9.05 °Brix) storage period. TSS was found

higher in Hisar safeda (10.11 °Brix) compared to VNR bihi (9.52 °Brix). Hisar Safeda accumulates higher TSS due to its genetic predisposition for faster ripening, more active sugar metabolism, and better assimilate partitioning into the fruit pulp compared to VNR Bihi. During early storage, guava ripens as starch and complex carbohydrates turn into simple sugars like glucose and fructose. This change leads to an increase in total soluble solids (TSS) (Singh *et al*., 2021). However, with longer storage, senescence occurs. Sugars get consumed through respiration, which reduces TSS. Moisture loss and tissue degradation also contribute to this decline (Jain *et al*., 2017). Treated fruits, especially those with gum acacia, showed a steady increase in TSS. This was due to lower respiration and water loss, which helped retain more sugar. Similar TSS patterns were seen in guava by Zaidi *et al*. (2023), Lo'ay *et al*. (2018), Tabasum *et al*. (2019), and Dutta *et al*. (2017), as well as in kinnow by Ahlawat *et al*. (2018).

Titrable acidity (%): Guava fruit's titratable acidity declined over the course of the storage time in both cultivars, Hisar safeda and VNR bihi. The TA of fruits gradually decreased from day zero (0.48%) to day eight (0.36%). During storage, guava continues to respire where organic acids (like citric, malic, ascorbic acids) are used as substrates in respiration, which leads to their gradual reduction. This is a natural part of the ripening process, making the fruit taste sweeter over time. Gum acacia 25% (T_4) coated fruits demonstrated the lowest TA (0.39% & 0.41% respectively) and the highest was in control (0.42% & 0.46% respectively). Uncoated guava fruits have higher titratable acidity because they ripen quickly and unevenly, resulting in a shorter shelf life and incomplete acid breakdown. On the other hand, gum acacia coating slows down oxygen movement and respiration. This extends the ripening period and allows for a more complete change of organic acids to sugars. As a result, acidity decreases more significantly by the end of storage. TA was higher in VNR bihi (0.43 %) compared to Hisar safeda (0.41 %) primarily due to its slower ripening, genetic tendency to retain organic acids, and less rapid degradation of acids during maturation. Kapoor *et al*. (2024) and El-Gioushy *et al*. (2022) in guava, Lelgut (2020) in mango, Alali *et al.* (2018) in banana and Sureshbhai (2021) in sapota depicted similar results.

Table 1: Effect of post-harvest treatments on total soluble solids (TSS) (°Brix) of guava cultivars

Variety (V) × Treatment (T) × Storage days (S)														
Treatments (T)			**Hisar Safeda (V_1)**						**VNR-Bihi (V_2)**					
			Storage Period (S)						Storage Period (S)					
			0 day	**2 days**	**4 days**	**6 days**	**8 days**	**Mean**	**0 day**	**2 days**	**4 days**	**6 days**	**8 days**	**Mean**
Control		T_1	9.81	10.45	10.79	9.41	8.88	**9.87**	9.09	9.79	9.87	9.22	7.65	**9.12**
Gum Acacia	15%	T_2	9.81	10.64	10.98	9.68	9.42	10.11	9.09	9.81	9.97	9.75	8.95	9.51
	20%	T_3	9.81	10.87	10.95	9.79	9.46	10.18	9.09	9.93	10.20	9.99	9.52	9.75
	25%	T_4	9.81	10.87	11.08	9.82	9.52	**10.22**	9.09	10.20	10.36	10.19	9.68	**9.90**
Calcium Nitrate	1%	T_5	9.81	10.64	10.95	9.57	9.26	10.05	9.09	9.25	10.06	9.63	8.33	9.27
	2%	T_6	9.81	10.50	10.79	10.26	9.23	10.12	9.09	9.94	10.12	9.71	8.72	9.52
	3%	T_7	9.81	10.82	11.02	9.72	9.43	10.16	9.09	10.07	10.22	9.99	9.06	9.69
Salicylic Acid	50ppm	T_8	9.81	10.80	10.92	9.68	9.28	10.10	9.09	9.80	10.02	9.12	8.45	9.30
	100ppm	T_9	9.81	10.81	11.04	9.70	9.25	10.12	9.09	10.00	10.29	9.83	8.53	9.55
	150ppm	T_{10}	9.81	10.72	11.04	9.99	9.44	10.20	9.09	10.15	10.24	9.91	9.65	9.81
Aloevera gel	60%	T_{11}	9.81	10.57	10.99	9.57	9.26	10.04	9.09	9.65	10.05	9.52	7.93	9.25
	80%	T_{12}	9.81	10.77	10.99	9.63	9.36	10.11	9.09	9.85	10.03	9.73	8.62	9.46
	100%	T_{13}	9.81	10.90	11.02	9.75	9.33	10.16	9.09	10.02	10.19	9.90	9.08	9.66
Mean			9.81	10.72	10.97	9.74	9.32		9.09	9.88	10.12	9.73	8.78	
CD at 5%			V = 0.01	T = 0.02	S = 0.01	V×T = 0.02		V×S = 0.01	T×S = 0.04		V×T×S = 0.05			

Ascorbic acid (mg/100g pulp): According to Veltman *et al*. (2000), ascorbic acid is a crucial nutrient that is very susceptible to oxidative destruction during food preparation and storage. The fruits' vitamin C content declined (from 162.80 mg/100g at S_1 to 144.74 mg/100g at S_5) as the storage time went on. The decline in ascorbic acid during storage may be caused by ascorbic acid oxidase's enzymatic conversion of L-ascorbic acid to dehydroascorbic acid (Tiwary, 2011). Ascorbic acid was higher in V_2 (157.09 mg/100g) compared to V_1 (150.91 mg/100g). VNR bihi guava contains more ascorbic acid than Hisar safeda due to its genetic makeup favoring higher biosynthesis and retention of vitamin C, slower ripening rate that reduces degradation, and more efficient nutrient allocation into the fruit pulp as it has thicker pulp

underneath the fruit skin. In Hisar safeda & VNR bihi, fruits treated with salicylic acid 150 ppm (T_{10}) had the highest ascorbic acid content (156.74 mg/100g & 161.30 mg/100g respectively). According to Kazemi *et al*. (2011), this may be because salicylic acid reduces or delays the activity of ascorbic acid oxidase. Similar findings were also reported by Amiri *et al*. (2021) in orange, Kapoor *et al*. (2024) and Supapvanich *et al*. (2017) in guava, Ennab *et al*. (2020) in mandarin and Wang *et al*. (2023) in pear. Nonetheless, untreated (T_1) fruits were found to have the lowest amount of vitamin C (144.01 mg/100g in V_1 & 152.60 mg/100g in V_2). According to Abbasi *et al*. (2012), peach fruits treated with 20 mmol/l salicylic acid retained a higher vitamin C content than fruits that were not treated. Abd El-Aziz (2020), Lo'ay and El-Khateeb (2011) and Tareen *et al*. (2012) also reported similar findings in guava and peach, respectively. According to Kalarani *et al*. (2002), tomato fruits treated with salicylic acid had a greater vitamin C content. Similar findings in peach cv Flordaprince were also reported by Awang *et al*. (2013).

Table 2: Effect of post-harvest treatments on titrable acidity (%) of guava cultivars

Variety (V) × Treatment (T) × Storage days (S)														
Treatments (T)			**Hisar Safeda (V_1)**						**VNR-Bihi (V_2)**					
			Storage Period (S)						Storage Period (S)					
			0 day	**2 days**	**4 days**	**6 days**	**8 days**	**Mean**	**0 day**	**2 days**	**4 days**	**6 days**	**8 days**	**Mean**
Control		T_1	0.46	0.44	0.42	0.39	0.38	**0.42**	0.49	0.48	0.47	0.45	0.40	**0.46**
Gum Acacia	15%	T_2	0.46	0.42	0.40	0.38	0.37	0.41	0.49	0.48	0.45	0.40	0.34	0.43
	20%	T_3	0.46	0.41	0.39	0.37	0.37	0.40	0.49	0.46	0.43	0.37	0.34	0.42
	25%	T_4	0.46	0.41	0.39	0.36	0.35	**0.39**	0.49	0.45	0.44	0.36	0.33	**0.41**
Calcium Nitrate	1%	T_5	0.46	0.42	0.41	0.40	0.37	0.41	0.49	0.48	0.45	0.39	0.36	0.43
	2%	T_6	0.46	0.42	0.40	0.38	0.36	0.40	0.49	0.48	0.44	0.38	0.36	0.43
	3%	T_7	0.46	0.41	0.40	0.38	0.36	0.40	0.49	0.46	0.43	0.37	0.34	0.42
Salicylic Acid	50ppm	T_8	0.46	0.42	0.40	0.39	0.38	0.41	0.49	0.48	0.45	0.41	0.34	0.43
	100ppm	T_9	0.46	0.42	0.40	0.38	0.37	0.41	0.49	0.48	0.44	0.39	0.35	0.43
	150ppm	T_{10}	0.46	0.41	0.39	0.37	0.36	0.40	0.49	0.46	0.43	0.37	0.33	0.42
Aloevera gel	60%	T_{11}	0.46	0.44	0.41	0.40	0.36	0.41	0.49	0.47	0.44	0.41	0.37	0.44
	80%	T_{12}	0.46	0.43	0.41	0.37	0.37	0.41	0.49	0.47	0.46	0.40	0.34	0.43
	100%	T_{13}	0.46	0.42	0.40	0.37	0.36	0.40	0.49	0.48	0.44	0.37	0.35	0.43
Mean			0.46	0.42	0.40	0.38	0.37		0.49	0.47	0.44	0.39	0.35	
CD at 5%			V = 0.01	T = 0.02	S = 0.01	V×T = NS		V×S = 0.01	T×S = NS		V×T×S = NS			

Total sugars (%): The results reveal that both cultivars' total sugar levels increased (from 5.39% at S_1) for up to four days (6.76% at S_3) before declining till the end of storage (5.23% at S_5). The initial rise in sugars may be due to rapid starch hydrolysis (Kumar, 2008), where the conversion rate exceeded utilization. In later stages, faster sugar consumption through respiration led to a decline (Hiwale and Singh, 2003). The total sugar was higher in V_1 (6.24 %) and lower in V_2 (5.59 %). Hisar safeda guava shows higher total sugars than VNR bihi because it ripens faster, has genetically stronger sugar accumulation pathways, softer pulp with more soluble content, and more efficient conversion of starch to sugars during ripening. Both cultivars showed a delayed overall decrease in total sugar content in gum acacia 25% (T_4) and gum acacia 20% (T_3) coated fruits. The gum acacia 25% (T_4) showed the highest level of total sugars (6.61% in V_1 & 5.84% in V_2), whereas the control (T_1) showed the lowest (5.80 % V_1 & 5.29 % in V_2) level. Treated guava fruits showed a gradual increase and sustained higher total sugar levels during storage due to suppressed respiration and ethylene production. This aligns with Dutta *et al*. (2017), who reported the highest total sugars (3.93%) in gum acacia 10% treated fruits and the lowest (3.13%) in uncoated ones. Similar findings were reported in guava (Singh, Bakshi *et al*., 2019; Kumar *et al*., 2011; Anjum *et al*., 2020), banana (Maqbool *et al*., 2011), pear (Kaur *et al*., 2013), and apple (Hossain *et al*., 2014).

Table 3: Effect of post-harvest treatments on total sugar (%) of guava cultivars

Variety (V) × Treatment (T) × Storage days (S)														
Treatments (T)			**Hisar Safeda (V_1)**						**VNR-Bihi (V_2)**					
			Storage Period (S)						Storage Period (S)					
			0 day	**2 days**	**4 days**	**6 days**	**8 days**	**Mean**	**0 day**	**2 days**	**4 days**	**6 days**	**8 days**	**Mean**
Control		T_1	5.54	6.03	6.50	5.80	5.12	**5.80**	5.23	5.84	6.16	4.86	4.36	**5.29**
Gum Acacia	15%	T_2	5.54	6.45	6.99	6.63	5.81	6.28	5.23	6.03	6.55	5.53	4.59	5.59
	20%	T_3	5.54	6.50	7.42	6.95	6.13	6.51	5.23	6.08	6.47	5.90	5.37	5.81
	25%	T_4	5.54	6.49	7.48	7.15	6.40	**6.61**	5.23	6.04	6.98	6.13	4.82	**5.84**
Calcium Nitrate	1%	T_5	5.54	5.84	6.76	6.22	5.48	5.97	5.23	5.70	6.44	5.30	4.48	5.43
	2%	T_6	5.54	6.46	7.02	6.62	5.83	6.29	5.23	6.09	6.58	5.68	4.52	5.62
	3%	T_7	5.54	6.46	7.09	6.72	5.96	6.35	5.23	6.07	6.67	5.87	4.65	5.70
Salicylic Acid	50ppm	T_8	5.54	6.25	6.74	6.27	5.61	6.08	5.23	5.64	6.38	5.33	4.46	5.41
	100ppm	T_9	5.54	6.57	7.02	6.64	5.86	6.33	5.23	6.00	6.67	5.66	4.67	5.65
	150ppm	T_{10}	5.54	6.65	7.09	6.89	6.21	6.48	5.23	6.21	6.82	5.71	4.68	5.73
Aloevera gel	60%	T_{11}	5.54	5.90	6.45	5.96	5.64	5.90	5.23	5.81	6.28	5.06	4.54	5.38
	80%	T_{12}	5.54	6.21	6.97	6.42	5.65	6.16	5.23	6.09	6.53	5.49	4.56	5.58
	100%	T_{13}	5.54	6.45	7.12	6.86	5.80	6.35	5.23	6.07	6.65	5.63	4.69	5.65
Mean			5.54	6.33	6.97	6.55	5.81		5.23	5.97	6.55	5.55	4.65	
CD at 5%			V = 0.04	T = 0.10	S = 0.06	V×T = 0.15		V×S = 0.09	T×S = NS		V×T×S = NS			

Physiological loss in weight (%): Fruit quality and storage life seemed to be mostly determined by physiological loss in weight (PLW). The fruits treated with gum acacia 25% (T_4) had the lowest (6.53 % in V_1 & 6.71% in V_2) PLW, while the untreated (control) fruits had the highest PLW in Hisar safeda (10.57%) and VNR bihi (8.71%). As the storage duration increased, the physiological loss in weight (PLW) increased noticeably from S_1 (0.00 %) to S_5 (16.13 %). Physiological loss in weight (PLW) during storage is mainly due to respiration and transpiration, which lead to moisture loss and reduced fruit weight (Chen *et al*., 2024). For the varieties V_1 and V_2, the overall mean for PLW was higher in V_1 (7.99 %) and lower in V_2 (7.92 %). Hisar safeda guava exhibits higher physiological loss in weight than VNR bihi due to its faster ripening, softer peel and pulp, higher respiration and transpiration rates, and lower natural moisture barriers. Guava (Mahajan *et al*., 2011; Krishna and Rao, 2014), strawberries (Gol *et al*., 2013), kiwifruit (Huang *et al*., 2016) and loquat (Song *et al*., 2016) have also exhibited an increase in PLW during storage. By forming a semi-permeable barrier that lowers moisture loss and respiration rate, gum acacia lessens the physiological loss in weight (Singh, Singh, Kaur *et al*., 2019). In guava, Dutta *et al*. (2017), Sreelakshmi *et al*. (2024), El-Gioushy *et al*. (2022) and Gurjar *et al*. (2018) have also reported the positive benefits of gum acacia coating in lowering the PLW. The results of Singh, Lal *et al*. (2024) in mango, González *et al*. (2024) in guava, Ali, Manickam *et al*. (2022) in pomegranate, Lopez-Ortiz *et al*. (2025) in grapes, Ali *et al*. (2016) in papaya, Tahir *et al*. (2018) in strawberry, Saleem *et al*. (2020) in persimmon, Fawole *et al*. (2024) in plum and Nxumalo *et al*. (2022) in kinnow mandarin all supported the present findings of gum acacia being able to reduce the PLW of fruits during storage compared to control.

Table 4: Effect of post-harvest treatments on ascorbic acid (mg/100g pulp) of guava cultivars

Variety (V) × Treatment (T) × Storage days (S)														
Treatments (T)			**Hisar Safeda (V_1)**						**VNR-Bihi (V_2)**					
			Storage Period (S)						Storage Period (S)					
			0 day	**2 days**	**4 days**	**6 days**	**8 days**	**Mean**	**0 day**	**2 days**	**4 days**	**6 days**	**8 days**	**Mean**
Control		T_1	162.20	152.34	144.06	134.71	126.73	**144.01**	163.40	157.97	152.77	147.20	141.66	**152.60**
Gum Acacia	15%	T_2	162.20	155.34	148.56	142.51	135.87	148.90	163.40	159.59	155.43	150.60	146.59	155.12
	20%	T_3	162.20	158.67	153.72	148.77	143.83	153.44	163.40	162.82	159.88	157.07	153.91	159.42
	25%	T_4	162.20	159.12	155.26	150.46	146.59	154.73	163.40	162.82	160.26	157.56	155.08	159.82
Calcium Nitrate	1%	T_5	162.20	155.15	148.36	142.03	135.06	148.56	163.40	159.48	155.14	150.03	145.96	154.80
	2%	T_6	162.20	158.41	152.67	147.36	141.92	152.51	163.40	162.42	158.97	155.20	151.76	158.35
	3%	T_7	162.20	158.54	152.97	147.92	142.87	152.90	163.40	162.82	159.64	156.59	153.43	159.18
Salicylic Acid	50ppm	T_8	162.20	155.85	149.76	143.81	137.77	149.88	163.40	160.64	156.48	152.29	148.56	156.27
	100ppm	T_9	162.20	158.74	154.66	149.74	145.00	154.07	163.40	162.82	161.50	158.80	157.30	160.76

	150ppm	T_{10}	162.20	160.25	157.14	153.98	150.12	**156.74**	163.40	162.86	162.12	159.48	158.66	**161.30**
Aloevera gel	60%	T_{11}	162.20	152.95	144.81	137.90	130.54	145.68	163.40	158.16	153.53	147.98	143.25	153.26
	80%	T_{12}	162.20	154.71	147.87	141.43	134.39	148.12	163.40	159.16	154.61	149.40	145.24	154.36
	100%	T_{13}	162.20	158.39	152.52	147.16	141.40	152.33	163.40	161.11	157.27	153.25	149.62	156.93
Mean			162.20	156.80	150.95	145.21	139.39		163.40	160.97	157.51	153.50	150.08	
CD at 5%			V = 0.11	T = 0.27	S = 0.17	V×T = 0.38		V×S = 0.24		T×S = 0.61		V×T×S = 0.86		

Table 5: Effect of post-harvest treatments on physiological loss in weight (%) of guava cultivars

Variety (V) × Treatment (T) × Storage days (S)

Treatments (T)			**Hisar Safeda (V_1)** Storage Period (S)						**VNR-Bihi (V_2)** Storage Period (S)					
			0 day	**2 days**	**4 days**	**6 days**	**8 days**	**Mean**	**0 day**	**2 days**	**4 days**	**6 days**	**8 days**	**Mean**
Control		T_1	0.00	5.16	10.45	15.99	21.25	**10.57**	0.00	5.29	8.62	12.85	16.78	**8.71**
Gum Acacia	15%	T_2	0.00	4.12	7.09	13.04	17.41	8.33	0.00	4.74	8.06	12.15	15.88	8.17
	20%	T_3	0.00	3.62	6.94	11.78	15.64	7.60	0.00	3.92	7.75	12.02	15.64	7.87
	25%	T_4	0.00	2.50	4.86	10.80	14.50	**6.53**	0.00	3.42	6.32	10.02	13.81	**6.71**
Calcium Nitrate	1%	T_5	0.00	3.76	6.97	12.84	15.68	7.85	0.00	4.85	7.73	11.69	15.84	8.02
	2%	T_6	0.00	3.03	5.20	10.93	14.53	6.74	0.00	3.11	7.48	11.80	15.01	7.48
	3%	T_7	0.00	2.73	5.06	10.88	14.54	6.64	0.00	3.69	6.98	10.48	14.44	7.12
Salicylic Acid	50ppm	T_8	0.00	4.36	7.29	14.53	18.45	8.93	0.00	4.64	8.30	12.61	16.38	8.39
	100ppm	T_9	0.00	3.96	7.01	12.90	16.55	8.08	0.00	4.28	7.99	12.15	16.01	8.09
	150ppm	T_{10}	0.00	3.31	5.88	11.36	15.11	7.13	0.00	4.49	7.62	11.50	15.08	7.74
Aloevera gel	60%	T_{11}	0.00	4.64	8.77	14.77	19.04	9.44	0.00	4.89	8.25	12.46	16.51	8.42
	80%	T_{12}	0.00	4.13	7.24	13.15	17.78	8.46	0.00	4.79	8.06	12.30	16.31	8.29
	100%	T_{13}	0.00	3.64	6.55	12.58	15.33	7.62	0.00	4.61	7.65	11.99	15.81	8.01
Mean			0.00	3.77	6.87	12.73	16.60		0.00	4.36	7.75	11.85	15.65	
CD at 5%			V = 0.01	T = 0.10	S = 0.06	V×T = 0.02		V×S = 0.01		T×S = 0.03		V×T×S = 0.04		

Decay loss (%): The decay loss of fruits increased as the storage duration went on from S_1 (0.00 %) to S_5 (18.83 %), however all post-harvest treatments considerably decreased decay loss compared to the control (12.55% in V_1 & 13.42% in V_2). Fruits treated with calcium nitrate 3% (T_7) in both cultivars showed the least amount (V_1-6.37% & V_2-7.20%) of decay loss. Fruit softening and degradation are caused by ongoing biochemical changes in fruits, which ultimately lowers fruit quality. Similarly, microorganisms like *Aspergillus, Penicillium* and *Colletotrichum* flourish in overripe or damaged fruits during extended storage (Menaka *et al*., 2024) These alterations may be somewhat slowed down in cold storage (Kaur and Bal, 2014). Calcium's capacity to preserve cell membrane and wall integrity, structure-related pectin polymers and cell cohesion may be the reason for the lower fruit decay seen in calcium-treated fruit (Aghdam *et al*., 2012; Roberto *et al*., 2019). By increasing antioxidant activity and forming a physical barrier against oxidative stress and microbial invasion, gum acacia coating lowers degradation loss (Salehi 2020). Azam *et al*. (2021) observed that guava fruit treated with 4% and 3% calcium nitrate had a decreased proportion of fruit degradation compared to the control treatment. El-Bana *et al*. (2023) in Mandarin and similar findings in strawberry fruits (Selvan & Bal, 2005; Martinsson *et al*., 2006, Rehman *et al*., 2020). Using acacia gum minimum decay loss was observed in guava by Kumar *et al*. (2024), in mangoes by Prasad *et al*. (2022) and in Ponkan citrus by Huang *et al*. (2021).

Table 6: Effect of post-harvest treatments on decay loss (%) of guava cultivars

Variety (V) × Treatment (T) × Storage days (S)

Treatments (T)			**Hisar Safeda (V_1)** Storage Period (S)						**VNR-Bihi (V_2)** Storage Period (S)					
			0 day	**2 days**	**4 days**	**6 days**	**8 days**	**Mean**	**0 day**	**2 days**	**4 days**	**6 days**	**8 days**	**Mean**
Control		T_1	0.00	5.89	14.39	18.09	24.36	**12.55**	0.00	6.10	15.81	19.59	25.59	**13.42**
Gum Acacia	15%	T_2	0.00	0.00	11.06	14.76	17.70	8.70	0.00	0.00	12.48	16.27	18.94	9.54
	20%	T_3	0.00	0.00	9.39	13.09	16.03	7.70	0.00	0.00	10.81	14.59	17.27	8.53
	25%	T_4	0.00	0.00	7.12	9.77	16.04	6.59	0.00	0.00	7.49	11.27	17.28	7.21
Calcium	1%	T_5	0.00	0.00	11.06	13.09	17.70	8.37	0.00	0.00	12.48	14.59	18.93	9.20

Nitrate	2%	T_6	0.00	0.00	7.73	9.76	16.03	6.70	0.00	0.00	9.15	11.28	17.30	7.55
	3%	T_7	0.00	0.00	6.06	9.76	16.03	**6.37**	0.00	0.00	7.48	11.26	17.26	**7.20**
Salicylic Acid	50ppm	T_8	0.00	2.21	12.73	16.42	21.03	10.48	0.00	4.28	14.15	17.92	22.26	11.72
	100ppm	T_9	0.00	0.00	11.08	13.10	17.72	8.38	0.00	0.00	12.48	16.26	18.93	9.53
	150ppm	T_{10}	0.00	0.00	9.39	11.42	16.03	7.37	0.00	0.00	10.81	12.92	17.26	8.20
Aloevera gel	60%	T_{11}	0.00	4.96	12.73	18.09	22.70	11.70	0.00	5.01	14.15	19.59	23.93	12.54
	80%	T_{12}	0.00	0.00	11.09	14.76	17.73	8.72	0.00	2.17	12.48	14.59	18.93	9.63
	100%	T_{13}	0.00	0.00	9.39	13.09	17.70	8.04	0.00	0.00	10.81	14.59	18.93	8.87
Mean			0.00	1.00	10.25	13.48	18.22		0.00	1.35	11.58	14.98	19.45	
CD at 5%			V = 0.11	T = 0.27	S = 0.17	V×T = NS		V×S = 0.24		T×S = 0.61		V×T×S = NS		

Shelf life (days): The gum acacia 25% (T_4) treatment had the longest shelf life (7.2 days and 7.0 days), followed by the calcium nitrate 3% (T_7) treatment (7.0 days and 6.9 days). The control (T_1) cultivars in Hisar Safeda and VNR Bihi had minimum shelf lives of 5.1 days and 4.9 days, respectively. The outcome was consistent with the findings of Daisy *et al*. (2020) for mango, Bordoh *et al*. (2022) in dragon fruit and El-Gioushy *et al*. (2022) for guava.

Table 7: Effect of post-harvest treatments on shelf life (days) of guava cultivars

Treatments			Hisar Safeda	VNR-Bihi	
			Storage Period (days)	Storage Period (days)	Mean
Control		T_1	5.10	4.90	**4.99**
Gum Acacia	15%	T_2	5.60	6.30	5.96
	20%	T_3	6.30	6.80	6.55
	25%	T_4	7.20	7.00	**7.10**
Calcium Nitrate	1%	T_5	5.30	5.20	5.25
	2%	T_6	6.20	6.60	6.40
	3%	T_7	7.00	6.90	6.95
Salicylic Acid	50ppm	T_8	5.30	5.10	5.20
	100ppm	T_9	6.20	6.40	6.30
	150ppm	T_{10}	6.30	6.80	6.55
Aloevera gel	60%	T_{11}	5.30	5.00	5.15
	80%	T_{12}	5.50	5.40	5.45
	100%	T_{13}	6.30	6.70	6.50
Mean			5.97	6.08	
CD (5%)			V= 0.11	T= 0.29	V×T= 0.41

Summary and Conclusion

The experiment at the Post-Harvest Laboratory, Department of Horticulture, CCSHAU, Hisar, during 2024 to 2025, evaluated how post-harvest treatments affected the quality and shelf life of rainy season guava (*Psidium guajava* L.). The findings showed that storage duration had a significant impact on the quality of both cultivars, Hisar safeda and VNR bihi. Among the treatments, 25% gum acacia was the most effective in keeping higher levels of total soluble solids (TSS), titratable acidity and sugars throughout storage. It also helped to reduce physiological loss in weight (PLW), minimize decay, and extend shelf life, showing a clear advantage over untreated fruits. Furthermore, the 3% calcium nitrate treatment effectively reduced decay loss and supported overall fruit quality. The study concludes that both gum acacia and calcium nitrate treatments have strong potential to improve post-harvest quality and extend the shelf life of guava under normal storage conditions.

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