Postharvest quality of Guava (*Psidium guajava* L.) Cv. Dhawal Fruit affected by different physico-Chemical Treatments

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ABSTRACT

The present investigation was carried out at Post harvest Laboratory, Department of Horticulture, Sardar Vallabhbhai Patel University of Agriculture and Technology, Modipuram, Meerut to study the **"Effect of post-harvest treatments on the shelf life of Guava Fruit (*Psidium guajava* L.) cv. Dhawal"** was conducted in a Completely Randomized Design with 11 treatments viz. To- Control, T_1- Aloe vera gel 1%, T_2- Aloe vera gel 2%, T_3- Corn starch (0.5%), T_4- Corn starch 1%, T_5- Cassava starch 1% with sunflower oil, T_6- Cassava starch 2% with sunflower oil T_7- Cassava starch 3% with sunflower oil, T_8- $CaNO_3$ (0.5%), T_9- $CaNO_3$ 1%, T_{10}- Cassava starch 1% with sunflower oil and bee wax and their 3 replications, during the year 2023. The study presents several challenges, with one of the main difficulties ensuring uniformity in applying the various physico-chemical treatments to the guava fruits to obtain reliable and comparable results. Additionally, controlling external factors such as temperature and humidity during the postharvest period can be a significant challenge to accurately assess the impact of these treatments on the fruit's quality and shelf life. Out of 11 treatments applied the fruits treated with Corn starch (1%) and Corn starch (0.5%) had significantly better fruit quality over other treatments in respect of parameters i.e., Physiological loss in weight, Decay percent, Fruit firmness, Sensory evaluation test, T.S.S., pH, Titrability acidity, reducing sugar. The Aloe vera gel were also found to be significantly superior treatments over the control in respect of storage quality and shelf- life. Based on results obtained in the present study, it can be concluded that Corn starch 1% was found to be the most appropriate treatment in Guava cv. Dhawal on account of better shelf- life. Therefore, Corn starch 1% can be adopted with great success in Guava cv. Dhawal for physico-chemical traits, storage, quality and shelf-life on commercial scale.

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Key words: Post-harvest treatments, Guava fruit, Corn starch, Aloe vera gel, Shelf life

INTRODUCTION

Guava (*Psidium guajava* L.) is a tropical fruit belonging to the family Myrtaceae with chromosome number 2n = 22 and commonly known as "Apple of Tropics". Under this genus, more than 5000 species are present. During the 17th century, it was introduced in India and at present, it is widely cultivated on a commercial scale. It has been reported that Indo-Gangetic plains have much genetic diversity of guava. According to the report of **Anonymous (2021)**, India is the leading guava-

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producing country, which is followed by its neighboring countries China, Pakistan and Indonesia. The leading state in the production of guava fruit is U.P which is followed by M.P and Bihar. The number of varieties is commercially cultivated in India. Some of the most popular and widely grown varieties are Sardar guava, Shweta, Allahabad Safeda, Arka Mridula, Chittidar, Lalit and Pant Prabhat. Guava is also the important crop of Punjab and ranks second after citrus. It grows well in almost all the districts of the state covering an area of 2.5 lakh ha, yielding 195.60 thousand MT accounted for 3.97 % of the area and 4.42 % of production. Guava is one of the nutritious fruits, Each 100 gm guava contains 228.3 mg Vitamin C, 80.80 g Water, 68 kcal Energy, 2.55 g Protein, 0.95 g Total lipid (fat), 14.32 g Carbohydrate, 5.4 g fiber, 8.92 g Sugars, 18 mg Calcium, 0.26 mg Iron, 22 mg Magnesium, 40 mg Phosphorus, 417 mg Potassium, 2 mg Sodium, 0.23 mg Zinc and others. Under ambient conditions, the shelf life of guava is about 3-4 days (**Sudhir Pratap**, **2021)**. Fruit is climacteric in nature with a thin exocarp layer that makes it hard for the fruit to retain moisture. Fruits can have their quality and shelf life preserved through post-harvest procedures. The primary aim of chemical treatment is to minimize fruit quality losses and extend the shelf life of guava. In addition to fungicides, other compounds can also delay ripening, senescence and the lengthening of fruit storage life. To keep the amount of ethylene below the threshold, ethylene scavengers are used. In addition to pesticides, plant growth regulators can help extend the guava plant's post-harvest life. Plant growth regulators, or phytochemicals, have been shown to extend the shelf life and value of guava when stored at varying concentrations. With 5.42 million tonnes produced year, India leads the world's guava production rankings, followed by China, Indonesia, Pakistan, Mexico, Brazil, Malawi, Thailand, Bangladesh and Vietnam. Compared to the previous year, when it exported 12,301.63 tonnes of guava valued at Rs. 6714.61 lakhs in 2022–2023–India exported 11,740.67 tonnes in 2023–2024 according to **Anon, (2022).**

Dhawal, an improved variety. It is seedling selection, heavy bearer (about 20% higher than Allahabad safeda. Matures fruits develop a light-yellow color on ripening. Fruits are soft seeded, pulp white, taste sweet with muskiness. Average yield should be 384q/ha.

Edible coatings have created a novel solution to the fruit quality issue in the modern day by slowing down the produce's metabolism and ethylene production, which postpones ripening. Fruits can have their quality and shelf life preserved through post-harvest procedures. The primary aim of chemical treatment is to minimize fruit quality losses and extend the shelf life of guava. In addition

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to fungicides, other compounds can also delay ripening, senescence and the lengthening of fruit storage life. To keep the amount of ethylene below the threshold, ethylene scavengers are used. In addition to pesticides, plant growth regulators can help extend the guava plant's post-harvest life. Phytochemicals *viz.*, plant growth regulators at different concentrations have been reported to enhance shelf life and value of guava during storing **Baldwin *et al.* (1995)**. The use of edible coating is a common issue that is beneficial to protect nutrients of food especially fruits and vegetables and provides a long durability. These are a thin layer of edible material which restrict water loss, oxygen and other soluble materials of food. Aloe vera gel is most recognized for its ability to heal injured or irritated skin, but in the future, it may also be used as a nutritious fruit and vegetable addition. There are antifungal properties in aloe vera gel. In addition to acting as a moisture barrier and a barrier to CO_2 and O_2, the gel also minimizes weight loss, browning, softening and the growth of mould and yeast. A thin covering that is applied to a fruit's surface and consumed along with it is known as an edible coating. It is used to extend shelf life, minimize moisture loss, enhance handling qualities and lessen the requirement for packing materials. The layer serves as a barrier against moisture and vapour transmission, extending the shelf life. Because the polymers can form hydrogen bonds efficiently, the edible coating creates a strong lipid and oxygen barrier at low to intermediate RH. The study's outcomes can lead to improved post-harvest handling techniques, extended shelf life and optimized post-harvest quality processes for, guava benefiting both producers and consumers. Considering the above facts, the present study was carried out on: we examined the postharvest quality of guava (*Psidium guajava* L.) cv. Dhawal fruit as affected by different physico-chemical treatments.

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MATERIAL AND METHODS

The present investigation was carried out at the Postharvest lab, College of Horticulture and Agro processing Centre (CoPHT & FP) of Sardar Vallabhbhai Patel University of Agriculture & Technology, Meerut U.P. India, during the year 2022. Geographically, the Meerut is situated between 29º04' North latitude, 77°42' East longitude and at an altitude of 237.75 meters above the mean sea level. The variety Dhawal was selected for the study and periodically observed. The fruits were obtained from 06 years old orchard of guava cultivar "Dhawal" planted at a distance of 6×6 m. Observation taken during the period of storage, Physiological loss in weight (PLW), Decay percentage, Fruit firmness, Sensory analysis, Total Soluble Solid (TSS), pH of guava pulp, Total

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titratable acidity percentage and Reducing sugar. The trial was laid out in a Complete Randomized Design (CRD) and the number of treatments was 11, each replicated thrice. The present observations were carried out at 0 day, 3rd, 6th and 9th day during storage. Physiological loss in weight (PLW) was calculated manually during the trial period and its value was calculated by using a formula which was given by Srivastava and Tandon (1968). Data on the Decay/spoilage were recorded during storage and expressed as percentages based on the appearance of visible symptoms of spoilage and unmarketable. The firmness of guava fruit was measured by penetrometer during the trial period and expressed as kg/cm^2. Sensory analysis of fruit for organoleptic taste, flavor, Aroma, Fruit freshness and Acceptability for all the samples was done using the Hedonic scale. A panel of eight judges aged 21-50 years was made on their consistency and reliability of judgment. The total soluble solid in fruit juice was determined with the help of hand refractometer (0-32 range) and TSS was recorded in degree Brix. Freshly collected clear juice from each guava treatment was taken separately and the pH pulp was measured using a pH meter. The reducing sugar content was determined using titrimetric procedures, while the total titratable acidity (%) was calculated by titrating the extracted juice with 0.01N NaOH, following the standard method with phenolphthalein as the indicator. Statistical analysis of the data was performed using standard procedure as described by **Gomez and Gomez (1996).**

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RESULTS AND DISCUSSION

The present guava data in Table 1 showed that the physiological loss in weight (PLW) of stored fruits treated with Corn starch (1%) was found statistically superior over rest of the treatments with minimum percent physiological loss in weight during 3rd, 6th and 9th day of the storage (3.17, 7.22, 10.34) respectively followed by Corn starch (0.5%) (3.74, 8.06 and 10.42). A similar trend was also observed by **Jagdeesh *et al.* (2006).** No decay percent was recorded in all the treatments on the 3rd day after storage, while on 6th day Corn starch (0.5%) fruits remain no decay and Corn starch (1%) was found to be minimum decay of (1.00). On 9th day of storage, the minimum decay percentage was recorded in Corn starch (0.5%) and Corn starch (1%) are (5.10 and 5.73) respectively and the maximum percent of decay were recorded in control (0.0, 6.00 and 14.00). Similar trend was also observed by **Wang *et al.* (2019).** On the initial day fruit firmness were recorded (4.70). On the 3rd day of storage, the treatment with Corn starch (1%) was the most effective in retaining fruit firmness, followed by Corn starch (0.5%) (5.39 and 5.24) kg/cm^2

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respectively. By the 6th day of storage, the most effective treatments for preserving fruit firmness were Corn starch 1% and Corn starch (0.5%) are (4.65,4.48) kg/cm^2. On the 9th day of storage, the treatments with Corn starch 1%, Corn starch (0.5%) were effective in slowing down the decline in fruit firmness (3.38, 3.10) kg/cm^2 respectively. In general, the firmness decreases as fruits become more mature and decreases rapidly as they ripe. The firmness (kg/cm^2) of guava fruits decreased continuously throughout the storage period which probably due to enzymatic degradation **Chitarra *et al.* (2002).** Sensory evaluation test on the 3rd day obtained maximum mean 7.83 value when fruit was treated with Corn starch 1% followed by Corn starch (0.5%) 7.42 respectively, while on 6th and 9th day, Sensory evaluation tests were conducted in which Corn starch (0.5%) and Corn starch (0.5%) obtained highest Sensory evaluation score (8.48, 8.09) respectively. While the minimum sensory score (5.98 and 5.77) on 3rd day of storage were recorded when fruit treated with Cassava starch 1% with Sunflower oil 1% and Beewax 1% and the control. On the 6th and 9th day of storage lowest sensory evaluation scores (6.52, 7.21) and (5.97, 6.81) were obtained by Cassava starch 1% with Sunflower oil 1% and Beewax and Control respectively. A similar trend was followed by **Chauhan *et al.* (2008)** in their experiment Aloe vera 5% and Aloe vera 10% found best sensory evaluation scores.

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		Day of storage (at ambient room temperature)															
		Physiological weight in loss (PLW)				Decay percentage				Firmness of guava fruit				Sensory evaluation test			
	Treatments	0th	3rd	6th	9th	0th	3rd	6th	9th	0th	3rd	6th	9th	3rd	6th	9th	
T0	Control	0	5.14	12.62	14.46	0	0	6.00	14.00	4.70	5.09	4.10	2.30	5.77	6.52	5.97	
T1	Aloe vera gel 1%	0	5.46	11.33	13.23	0	0	5.20	11.23	4.70	4.50	3.80	2.25	7.14	7.26	7.25	
T2	Aloe vera gel 2%	0	4.44	13.33	13.30	0	0	5.23	12.00	4.70	4.70	3.97	2.28	7.17	7.30	7.17	
T3	Corn starch (0.5%)	0	3.74	8.06	10.42	0	0	0.00	5.10	4.70	5.24	4.48	3.10	7.42	8.48	8.09	
T4	Corn starch 1%	0	3.17	7.22	10.34	0	0	1.00	5.73	4.70	5.39	4.65	3.38	7.83	8.31	8.00	
T5	Cassava starch 1%+ Sunflower oil 1%	0	4.04	7.80	11.10	0	0	5.08	12.00	4.70	5.15	4.27	3.03	7.09	7.23	6.92	
T6	Cassava starch 2%+ Sunflower oil 1%	0	3.46	8.68	11.85	0	0	5.16	12.01	4.70	5.20	4.35	3.14	7.08	7.21	6.96	
T7	Cassava starch 3%+ Sunflower oil 1%	0	3.98	8.70	9.44	0	0	5.01	11.10	4.70	5.28	4.42	3.22	7.09	7.23	6.99	
T8	CaNO3(0.5%)	0	3.65	7.83	9.33	0	0	5.53	8.16	4.70	5.22	4.50	3.45	6.99	7.34	6.99	
T9	CaNO3(1%)	0	4.31	8.03	9.68	0	0	5.66	8.66	4.70	5.35	4.70	3.88	7.00	7.35	6.98	
T10	Cassava starch 1%+ Sunflower oil 1%+Beewax 1%	0	4.68	7.24	10.84	0	0	5.10	12.04	4.70	5.12	4.28	3.15	5.98	7.34	6.81	
	Mean		4.18	9.16	10.32			4.63	10.18		5.11	4.32	3.016				
	SE(m)		0.286	0.47	0.426			0.447	0.416		0.191	0.61	1.069				
	C.D at 5%		0.843	0.98	1.242			1.319	1.227		0.27	0.23	0.352				
	C.V. (%)		11.24	6.266	6.498			17.01	7.069		5.497	6.477	6.852				

Table 1 : Day of storage (at ambient room temperature) for Physiological weight loss

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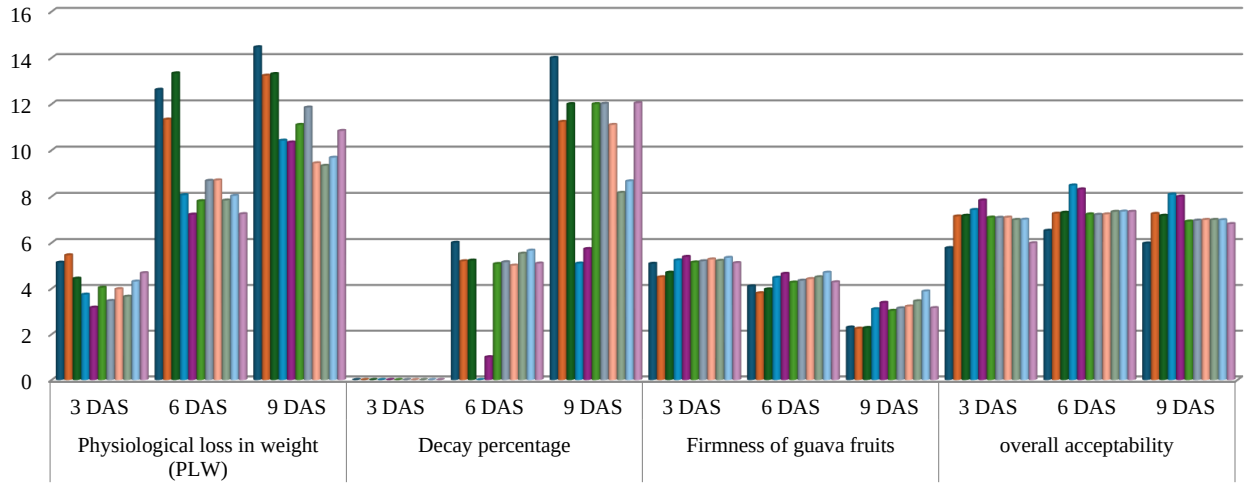
Fig .1 Bar graph showing physiological and firmness in guava



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The present guava data in Table 2. Showed, there was a gradual increase in TSS from the 3rd to the 6th day of storage, followed by a notable decline. The fruits treated with Corn starch (1%) consistently exhibited statistically superior results over the other treatments, showing the highest TSS levels on the 3rd, 6th and 9th day of storage (10.74, 11.62 and 12.10) ºBrix respectively. Corn starch (0.5%) (10.70, 11.48 and 11.96) ºBrix also performed well, yielding superior TSS levels on the respective days. Similar trend was also observed by **Martinez-Romero *et al.* (2006)** found that guava fruits treated with corn starch and aloe vera gel had higher levels of TSS. On the 3rd day of storage, the fruits treated with Corn starch 1% exhibited higher pH (3.87) values compared to other treatments, followed by Corn starch (0.5%) (3.85) and Cassava starch 1% with sunflower oil 1% and beewax 1% also exhibited pH (3.86). The treatments with Cassava starch 2% with sunflower oil 1% resulted in the lowest pH values on the 3rd, 6th and 9th day (3.72, 3.80 and 3.94) respectively. On the 6th day of storage, the maximum pH values were observed when fruits were treated with Corn starch 1% and Corn starch (0.5%) were (4.17 and 4.12) respectively. During the 9th day of storage, the maximum pH values were recorded when fruit was treated with Corn starch 1% (4.36). An increasing trend in pH value was recorded during storage period. This fluctuation in pH due might be due to the variations in titrable acidity or temperature or storage (**Hames and Hooper 2000).**

On the 3rd day of storage, the treatments with Corn starch (0.5%), Corn starch 1% and $CaNO_3$ resulted in higher titrable acidity levels (0.47, 0.45 and 0.46) respectively. Conversely, the Cassava starch 2% with Sunflower oil 1% and Cassava starch 1% and 3% with Sunflower oil 1% treatments exhibited the lowest titrable acidity levels (0.34, 0.37,0.37) on the 3rd day of storage. On the 6th day of storage, the highest titrable acidity levels were observed in the Corn starch 1% treatment (0.44), followed by the Corn starch (0.5%) treatment (0.42). The lowest titrable acidity (0.30) levels were recorded in the treatment the Cassava starch 2% with Sunflower oil 1% and the Cassava starch 3% with Sunflower oil 1% are same. Moving on to the 9th day of storage, the treatments with Corn starch (0.5%) and $CaNO_3$ (1%) resulted in the highest titrable acidity levels 0.36 and 0.35 respectivelly. Overall, the best treatment for titrable acidity percentage throughout the study was found to be Corn starch (0.5%). The decrease in total acidity in guava during ripening is probably due to decrease in citric acid. **Garg *et al.* (2015)** they reported that Corn starch with waxol found minimum titrable acidity during storage of guava fruits. The reducing sugar of guava was recorded on the 3rd day of storage, Control, Cassava starch 3% with Sunflower oil 1% and Cassava starch 2% with Sunflower oil 1% were found to minimum reducing sugar (2.62, 2.70 and 2.84) on the other hand maximum reducing sugar will be recorded on Corn starch 1% and Corn starch (0.5%) were the (3.84, 3.78) respectively. while on 6th day of storage Cassava starch

1% with Sunflower oil 1% and beewax 1%, Cassava starch 3% with Sunflower oil 1% and Cassava starch 2% with Sunflower oil 1% found minimum reducing sugar (3.10, 3.11 and 3.15) respectively and maximum were recorded on Corn starch 1% and Corn starch (0.5%) are (4.35 and 4.29) respectively. On 9th day of storage, the lowest reducing sugar (3.01, 3.07 and 3.11) were recorded when fruit were treated with Cassava starch 1% with Sunflower oil 1% and bee wax 1%, Cassava starch 2% with Sunflower oil 1%, Cassava starch 3% with Sunflower oil 1% respectively and maximum were be Corn starch 1% and Corn starch (0.5%) are (4.29, 4.26) respectively. Reducing sugar increased with increasing in storage period. This might be due to the hydrolysis of polysaccharides and conversion of non- reducing sugar into reducing sugar. The Results are well supported by **Jagdeesh (1994)** in corn starch coated fruits, **Singh and Mohammad (1993)** in wax coated guava.

							Days of storage (At ambidient room temperature)											
				T.S.S Brix			pH of guava fruits			Titrability acidity %				Reducing sugar of guava fruits				
	Treatments	0th	3rd	6th	9th	0th	3rd	6th	9th	0th	3rd	6th	9th	0th	3rd	6th	9th	
T0	Control	9.15	9.19	10.33	9.24	3.60	3.76	4.02	4.10	0.40	0.38	0.32	0.22	3.20	2.62	3.30	3.15	
T1	Aloe vera gel 1%	9.15	9.29	10.10	11.23	3.60	3.78	4.04	4.17	0.40	0.42	0.38	0.32	3.20	3.42	4.12	4.07	
T2	Aloe vera gel 2%	9.15	9.16	10.22	10.96	3.60	3.75	3.96	4.16	0.40	0.41	0.36	0.31	3.20	3.45	4.20	4.22	
T3	Corn starch (0.5%)	9.15	10.7	11.48	11.96	3.60	3.85	4.12	4.34	0.40	0.47	0.42	0.36	3.20	3.78	4.29	4.26	
T4	Corn starch 1%	9.15	10.74	11.62	12.10	3.60	3.87	4.17	4.36	0.40	0.45	0.44	0.32	3.20	3.84	4.35	4.29	
T5	Cassava starch 1%+ Sunflower oil 1%	9.15	9.72	10.02	9.82	3.60	3.75	3.82	4.00	0.40	0.37	0.32	0.3	3.20	3.14	3.18	3.14	
T6	Cassava starch 2%+ Sunflower oil 1%	9.15	9.80	10.20	9.02	3.60	3.72	3.80	3.94	0.40	0.34	0.30	0.22	3.20	2.84	3.15	3.07	
T7	Cassava starch 3%+ Sunflower oil 1%	9.15	9.15	10.14	9.00	3.60	3.74	3.79	4.00	0.40	0.37	0.30	0.23	3.20	2.70	3.11	3.11	
T8	CaNO3(0.5%)	9.15	8.20	10.00	10.26	3.60	3.82	4.25	4.20	0.40	0.44	0.40	0.32	3.20	3.34	4.19	4.10	
T9	CaNO3(1%)	9.15	8.13	10.13	10.96	3.60	3.84	4.30	4.32	0.40	0.46	0.38	0.35	3.20	3.40	4.25	4.11	
T10	Cassava starch 1%+ Sunflower oil 1%+Beewax 1%	9.15	8.73	9.50	9.77	3.60	3.86	3.90	4.09	0.40	0.38	0.31	0.25	3.20	2.91	3.10	3.01	
	Mean		9.34	10.25	10.40		3.79	4.00	4.15		0.41	0.35	0.29		3.22	3.74	3.68	
	SE(m)		0.35	0.379	0.36		0.03	0.021	0.062		0.013	0.011	0.008		0.177	0.122	0.133	
	C.D at 5%		1.015	1.092	0.987		0.088	0.064	N/A		0.038	0.034	0.032		0.344	0.359	0.393	
	C.V. (%)		6.371	7.146	6.022		1.351	0.829	3.76		5.417	6.268	6.41		6.261	5.674	6.261	

Table 2: Days of storage (At ambidient room temperature) in guava fruits

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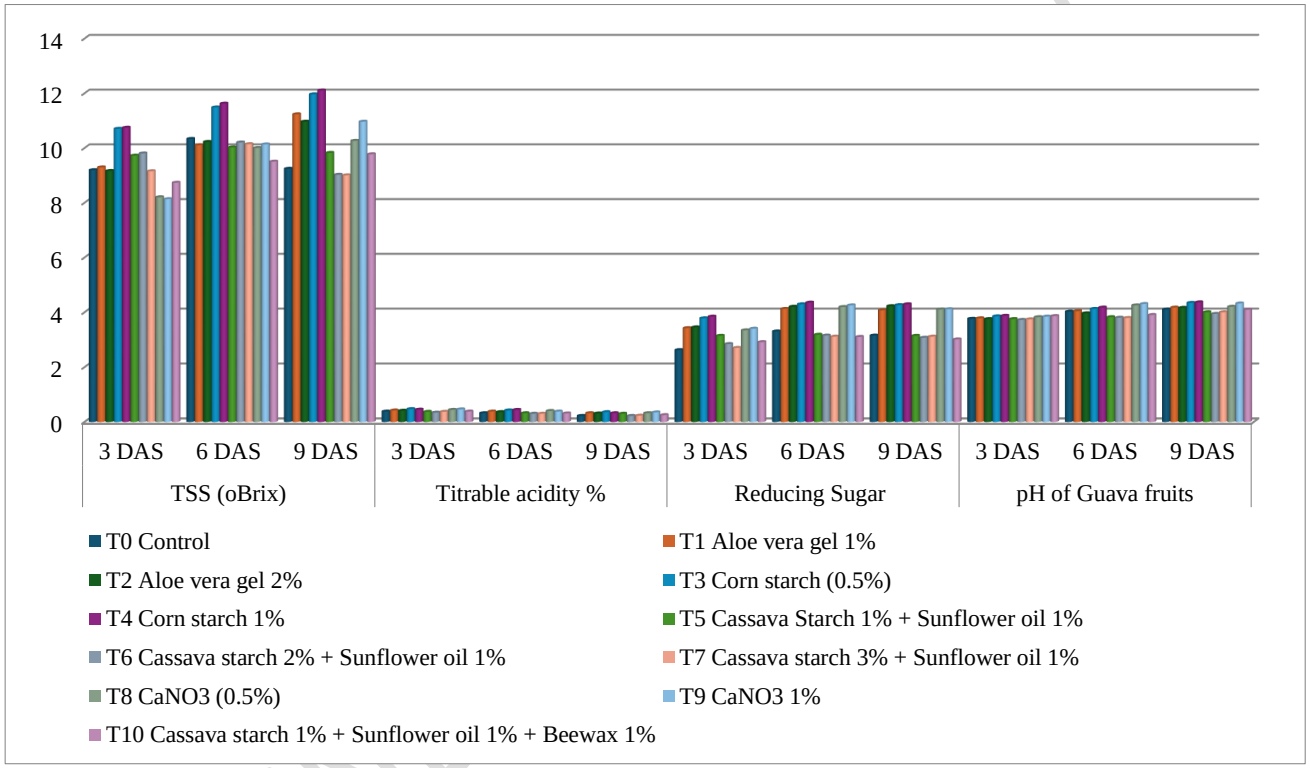

Fig .2 : Bar graph showing parametric evaluation among guava fruits

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CONCLUSIONS

Based on the findings of this study, it can be concluded that Corn starch at a concentration of (1%) showed the best treatment for the enhancing of shelf life of guava cv. Dhawal during the 3rd, 6th and 9th day of storage, followed by Corn starch (0.5%) was found to be effective. Corn starch at 1% was observed to positively affect the post-harvest quality of guava fruits. Post-harvest life of guava fruits extended when fruit were treated with Corn starch (0.5%) during the storage period.

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FUTURE SCOPE

The future prospects of the study hold significant promise for the fruit industry and consumers. The insights gained from this research can pave the way for the development of advanced post-harvest handling techniques and storage methods that can extend the shelf life of guavas and maintain their quality during transportation. By optimizing the ripening process, it may be possible to offer consumers guavas with better taste, texture and nutritional value. Additionally, the findings could potentially lead to the formulation of eco-friendly and sustainable treatments to enhance post-harvest characteristics, reducing food waste and improving overall supply chain efficiency. The study's results could play a crucial role in shaping the guavas industry's practices, benefiting growers, exporters, retailers and consumers by ensuring a more reliable and enjoyable guava experience.

DISCLAIMER (ARTIFICIAL INTELLIGENCE)

Author(s) hereby declare that NO generative AI technologies such as Large Language Models (ChatGPT, COPILOT, etc) and text-to-image generators have been used during writing or editing of manuscripts.

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