Sodium Nitroprusside-Shellac composite coating extended shelf life of sapota cv. Cricket Ball at ambient temperature

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ABSTRACT

Sapota, a promising fruit of India for its delicious taste, sugar rich, high energy and sweet pulp, packed with vitamins, minerals and antioxidants. This climacteric fruit has short shelf life at ambient condition. Therefore, in the present experiment one proven chemical; Sodium nitroprusside (SNP) as ethylene blocker and anti-senescent agent was used along with a natural, biodegradable resin name shellac (SC), commonly used as surface coating in fruits and vegetables for extension of shelf life; as sole or as composite coatings through nine different treatments viz. T_1: SNP 0.02mM, T_2: SNP 0.05mM, T_3: SC 2%, T_4: SC 5%, T_5:0.02mM SNP+ SC 2%, T_6:0.02mM SNP+ SC 5%, T_7:0.05mM SNP+ SC 2%, T_8:0.05mM SNP+ SC 5%, T_9:Control (Water dipped), laid out in complete randomized design with five replication under ambient condition (temperature 20-25^{0}C, relative humidity 65-85%). Results manifested that sapota treated with 0.02mM SNP + 5% shellac coating had minimum weight loss (11.59%) with high fruit firmness (29.39N cm^{-2}), TSS (18.86^{0}Brix), total sugar (16.87%) and ascorbic acid content (10.32 mg 100g^{-1}) at 12 DAS. Besides, fruits under this treatment had minimum fruit decay (13.33%) resulted in highest shelf life (13.73 days). Thus, postharvest composite coating of SNP (0.02mM) and shellac (5%) can be a potential approach for shelf-life extension of sapota at ambient condition.

Keywords: Antioxidant, ascorbic acid, composite coating, sapota, shelf life, total phenol

INTRODUCTION

Sapota (*Achras sapota* L.) fruits are good source of vitamins, minerals, antioxidants and flavonoids. High antioxidant activity of the sapota fruit juice was reported due the presence of phenolic compounds like gallic acid, chlorogenic acid, catechin, leucodelphinidin, leucopelargonidin, leucocyanidin, carotenoids and ascorbic acid etc. and was even found to use in traditional medicine (Rivas-Gastelum *et al.*, 2023). Sapota fruits are climacteric in nature and have very short shelf life due to its fast ripening, rapid moisture loss, quick senescence and high perishability (Siddiqui *et al.*, 2014). Sapota fruits are sensitive to cold storage which induces chilling injury (Brunda *et al.*, 2026). However, at ambient storage, fruit are reported to have very short shelf life of about 7 days (Siddiqui *et al.*, 2014).

Sodium nitroprusside (SNP) act as a nitric oxide (NO) donor for plants and reported to enhance plant tolerance to abiotic stresses, boost antioxidant defence mechanism, controls stomatal movements, besides, reported to predominantly play role in limiting ethylene production through binding with 1-amino cyclopropane-1-carboxylic acid (ACC) and ACC oxidase (Chandini *et al.*, 2026). SNP was reported to modulate postharvest quality and extend shelf life of fruits like custard apple (Chandini *et al.*, 2026), jamun (Kanaujia *et al.*, 2025), papaya (Pavankumar *et al.*, 2026) and hami melon (Jia *et al.*, 2026) etc. Shellac is a natural, biodegradable resin secreted by Lac insect (*Laccifer lacca*), considered as GRAS (generally recognized as safe), non-toxic substance having excellent film forming and barrier properties, water resistant thus potentially used as edible coatings (Chauhan *et al.*, 2015, Nanglia *et al.*, 2022) and found to extend shelf life for kaji lemon (Devi *et al.*, 2026), oranges (Singh *et al.*, 2026), mango (Ma *et al.*, 2021) and banana (Ndondo and Musunda, 2025) etc. fruits. Moreover, composite coatings of SNP along with surface barriers like chitosan had preserved quality of plums (Jan *et al.*, 2026) during storage, whereas shellac and aloe gel combined coating extended shelf life in tomato (Chauhan *et al.*, 2015).

Therefore, the present study was undertaken to evaluate SNP and shellac coatings sole and in combinations as composite coatings on shelf life and postharvest qualities of sapota stored at ambient condition.

MATERIALS AND METHODS

Freshly harvested fully mature unripe sapota fruits (cv. Cricket Ball) which were collected from Sam's Garden, Tanhril, Aizawl district, Mizoram, were used as experimental material. Fruits were sorted based on shape, size, disease/pests attack and visual quality and thoroughly washed in running tap water followed by rinsing in sterile water to remove dirt and dust adhering on skin and air dried at laboratory condition. Fruits were then treated with respective concentrations of SNP and shellac coatings (SC) under nine different treatments viz. T_1: SNP 0.02mM, T_2: SNP 0.05mM, T_3: SC 2%, T_4: SC 5%, T_5:0.02mM SNP+ SC 2%, T_6:0.02mM SNP+ SC 5%, T_7:0.05mM SNP+ SC 2%, T_8:0.05mM SNP+ SC 5%, T_9:Control (Water dipped).Treated fruits were stored at ambient condition (temperature 20-25^{0}C, relative humidity 65-85%) at Post Harvest Laboratory, Department of Horticulture, Aromatic and Medicinal Plants, Mizoram University, Aizawl, India, during May-June, 2023.

Respective concentration of SNP (0.02 and 0.05 mM) was prepared by dissolving in distilled water and fruits were then dipped for 30 minutes followed by air drying for sole SNP treatments. Respective concentration for shellac coating (2% and 5%) was prepared by dissolving bleached and de-waxed shellac in aqueous alkaline medium (0.5% ammonium hydroxide) at 95^{0}C and homogenized using oleic acid emulsifier (Chauhan *et al.*, 2015) and used for sole SC treatments. For composite coatings formulations were made by incorporating SNP and SC in appropriate ratio, homogenized and finally volume made up using distilled water. Glycerol (1% v/v) was used for all formulations as plasticizer effect.

Weight of the fruits were recorded by digital weighing balance (Kern PCB, Model: Z742836, Germany), pulp colour was determined using handheld colour meter (TES-3250 Color Meter, TES Electrical Electronic Corp., Taiwan) and expressed in CIELAB [L* (lightness), a* (red-green), b* (yellow-blue)] and fruit firmness was recorded by digital handheld penetrometer (PCE Instruments, Model: PCE-PTR 200N, UK) and expressed as Newton per square centimeter (N cm^{-2}). Fruit biochemical quality parameters viz. Total Soluble Solids (TSS; by digital refractometer, Hanna Instruments, Model: HI96801, Romania), titratable acidity (AOAC, 2023), TSS: acid ratio (by diving TSS value with titratable acidity value), total sugar (AOAC, 2023), ascorbic acid (Ranganna, 2017), and total phenol contents (Waghmare *et al.*, 2025) was measured at specific intervals (3 days) during storage. While antioxidant activity (Siddiqui *et al.*, 2024) and fruit decay (Mandal *et al.*, 2018) was determined at 12 DAS (days after storage). Shelf life (days) was evaluated depending on the fruit decay, fruit physico-chemical parameters and counting the days from harvest to the day with maximum visual, edible and marketable quality (Mandal *et al.*, 2025).

Statistical analysis of the data was done using SPSS (Version 22) software for calculating ANOVA by following the method of Complete Randomized Design (CRD) having nine treatments and five replications; with three fruits per replication (Mishra and Homa, 2019). Further, DMRT test was done for separation of means.

RESULTS AND DISCUSSION

Weight loss percentage of sapota in storage

It was observed that sapota fruits rapidly lost its physiological weight during ambient storage. Therefore, percentage of physiological weight loss of stored sapota gradually increased with duration of storage across the treatments. It was ranged between 2.35 % and 6.87 % at 3 DAS, between 6.06% and 13.56% at 6 DAS, between 8.43% and 17.86% at 9DAS whereas, at 12 DAS between 11.59% and 23.60% (Figure 1). It was reported that sapota, being a climacteric fruit, rapidly undergoes metabolic and physiological changes resulted in increased respiration, which utilizes the stored carbohydrate and contributes to moisture loss through transpiration and surface evaporation and causes loss of physiological weight of stored sapota (Baidya *et al.*, 2020; Brunda *et al.*, 2026). At 12 DAS, fruits treated with 0.02mM SNP along with 5% shellac coating found to have minimum weight loss (11.59%) in comparison to control (23.60%). SNP @200µM had controlled weight loss in stored rambutan due to its positive influence on cellular integrity and permeability of tissues (Zhang *et al.*, 2022). SNP-act as nitric oxide (NO) donor, slowed respiration rate and controlled weight loss in banana (Siddiqui *et al.*, 2024). Besides, edible coating with shellac reported to maintain turgor pressure and controlled fruit weight loss during storage (Singh *et al.*, 2026). Composite coating of 2mM SNP with 2% chitosan had resulted in better weight loss management in stored plum fruits (Jan *et al.*, 2026). Present study also revealed that composite coating of sapota fruits with SNP and shellac contributed to minimum weight loss.

Fruit decay and shelf life of sapota in storage

Present study revealed that sapota fruits treated with SNP @0.02mM along with 5% shellac coating had significantly controlled postharvest decay percentage, as recorded minimum (13.33%) compared with control (53.33%). Hence fruit under this treatment had maximum shelf life (13.73 days) contrasting with control (7.87 days) (Figure 2). SNP was reported have progressive role for resistance against tissue decay as found in Hami melons (Jia *et al.*, 2026). Romanazzi and Moumni (2022) reported edible coatings of shellac, chitosan, carboxymethyl cellulose, bee wax and glycerol to have antifungal and antioxidant properties which can extend the shelf life. Kanaujia *et al.* (2025) found that SNP @ 1.5 mM has extended shelf life of jamun fruits during cold storage. Chandini *et al.* (2026) opined that SNP as donor of NO was found to reduce ethylene production by binding with 1-aminocyclopropane-1-carboxylic acid (ACC) and ACC oxidase which was thought to play pivotal role in delaying ripening of stored fruits and extension of shelf life. Shellac is a potential film agent which can indulge extension of shelf life of fruit during postharvest condition (Krongrawa *et al.*, 2025). These were may be the reasons why composite coating with shellac along with SNP had extended shelf life of sapota under the present study.

Fruit firmness of sapota in storage

With duration of storage, sapota fruits lost its firmness across all the treatments. At 3 DAS, firmness of the stored fruits ranged between 62.46 and 85.92 N cm^{-2} which reduced and ranged between 47.38 and 78.35 N cm^{-2} at 6 DAS, which further decreased and ranged between 23.58 and 62.64 Ncm^{-2} at 9DAS and finally between 4.87 and 29.39 Ncm^{-2} at 12 DAS (Table 1). Among the treatments, fruits treated with 0.02mM SNP +5% shellac coating (T_6) maintained high fruit firmness (29.39 Ncm^{-2}) compared with control (4.87 Ncm^{-2}) at 12 DAS. SNP was found to impact significantly on maintenance of fruit firmness as reported to influence gene expression for synthesis of phenylpropanoid and promoted synthesis of lignin, while impacting β-galactosidase activity in relation to cell wall integrity (Hu *et al.*, 2025). Coating of fruits with shellac wax slowed metabolic activity and maintained cellular turgidity thus resulted in higher firmness (Nanglia *et al.*, 2022). Therefore, it may the reason behind better maintenance of fruit firmness in current study through combined effect of SNP and shellac coating on sapota.

Pulp colour of sapota in storage

Pulp colour of the stored sapota fruits got changed during ambient storage from greenish olive colour to dark brown (Table 1). Fruits treated with 0.02mM SNP along with 5% shellac coating (T_6) had remained the fruit pulp colour to greenish olive (L:61.89, a:-2.31, b:23.21) even at 12 DAS, whereas, fruit at control had dark brown colour of pulp (L:53.68, a:9.22, b:21.81). Fruits treated with 0.05mM SNP+ 5% shellac coating (T_8) also represented the pulp colour as light olive (L:67.37, a:-3.71, b:22.55) at 12 DAS. The change of fruit appearance during ripening is manifested by green colour sapota fruit to become light brown and pulp colour changes from greenish to brownish. Ripening associated changes in fruit skin and pulp colour is prominently observed in most of the climacteric fruit, however, SNP as a NO donor found to significantly slowed down the colour change through its ripening inhibitory effect (Siddiqui *et al.*, 2024). Shellac based edible coating found to modulate gaseous (O_2/CO_2) exchange, moisture maintenance and suppressed respirational ethylene promotion and consequently slowed down the ripening related colour changes in fruit during storage (Chauhan *et al.*, 2015). Therefore, in the current study, treatments combining SNP and shellac may have given synergistic effect in maintaining pulp colour and slowed down its changes to dark brown at advancement of ripening.

Total Soluble Solids (TSS) and titratable acidity of sapota in storage

It was observed that TSS content of the stored sapota fruit drastically increased during the period of storage up to 9 DAS. In some of the treatments, TSS slightly reduced afterward contrasting to T6, T7 and T8, where TSS accumulation continued even up to 12 DAS (Table 2). TSS content of stored sapota ranged between 9.56^0Brix to 16.87^0Brix at 3DAS, which increased and ranged between 13.25^0Brix and 19.56^0Brix at 9DAS (Table 2). At 12 DAS, TSS content was recorded highest (18.86^0Brix) in case of the fruits treated with 0.02mM SNP+ 5% shellac coating (T_6) compared to control (14.85^0Brix). Accumulation of TSS commonly happened in stored sapota due to ripening of fruits (Siddiqui *et al.*, 2014). However, at later stage, over ripening of stored sapota may have decreased the TSS content due to senescence. Post-harvest application of SNP reported to act as ethylene inhibitor and found to delay ripening and senescence in stored papaya as resulted in delayed accumulation of TSS (Pavankumar *et al.*, 2026). Shellac coating influenced gaseous exchange of stored fruit and delayed maturation and senescence which resulted in delayed accumulation of TSS (Devi *et al.*, 2026; Chauhan *et al.*, 2015). Thus, combined application of SNP and shellac coating resulted in better maintenance of TSS as represented in the present study.

Titratable acidity of the stored sapota fruits reduced significantly for all the treatments throughout the period of storage (Table 2). However, for the fruits at control, the rate of loss was faster as it dropped from 0.19% (at 3DAS) to 0.06% (at 12 DAS) contrasting with the fruits treated with 0.02 mM SNP + 5% shellac coating, where it was recorded 0.32% (at 3 DAS) to 0.17% (at 12 DAS). In the process of ripening organic acid converted to sugar and increase the soluble solid content, besides, undergo oxidation to provide energy in metabolic activities at ripening as reported also in case of stored sapota (Baidya *et al.*, 2020). However, anti-senescence effect of SNP (Pavankumar *et al.*, 2026) along with shellac coating (Chauhan *et al.*, 2015) may have preserved fruit acidity as reflected in the present study. Application of edible coatings reported to influence gaseous exchange of the stored fruit and also metabolic activities while ripening and resulted in better maintenance of titratable acidity during storage (Kunhilintakath and Chengaiyan, 2025). So, combined application of SNP as donor of nitric oxide and edible coating with shellac has resulted better fruit acidity retention in the current study.

TSS: acid ratio and total sugar content of sapota in storage

TSS: acid ratio was found to increase across all the treatments during ambient storage. However, fruits at control faced significantly higher value due to faster accumulation of TSS along with rapid loss in titratable acidity (Table 3). Baidya *et al.* (2020) had explained that hastening in ripening of sapota fruits manifested by rapid increase in TSS content with fast decline in acidity, which contributed to higher TSS: acid ratio. Contrastingly, in combined application of SNP and shellac coating delayed gain in TSS and retained titratable acidity, therefore, TSS: acid ratio reached its peak slowly after 9 DAS. Even though, sapota treated with 0.02mM SNP along with 2% shellac coating had scored minimum TSS: acid ratio (103.47) compared with control (247.50) at 12 DAS (Table 4). Elwahab *et al.* (2024) found that apricot fruits treated with SNP had gradual accumulation in TSS: acid ratio, as treatment contributed to delayed ripening, caused slower gain in TSS and breakdown of organic acids. Mandal *et al.* (2018) found delayed accumulation in TSS: acid ratio in mangoes due to different edible coatings like chitosan, aloe gel and wax etc. Banana surface coating with shellac, gelatin and polyethylene glycol reported to slow breakdown of fruit acidity and gradual increment in TSS as reduced respiration and ripening delay (Ndondo and Musunda, 2025). This is why the composite application of SNP along with shellac delayed the accumulation of TSS:acid ratio in stored sapota in comparison of control.

In the present study, it was observed that the sapota fruits increased its total sugar content across the treatments up to 9 days of storage. It was found that fruit's total sugar content ranged between 7.14 to 16.78% at 3DAS which got further increased and ranged between 11.56 to 17.23% at 9 DAS (Table 3). Being climacteric fruit, mature sapota undergone ripening with advancement in storage duration and biochemical changes at ripening may have caused hydrolysis to starch and conversion to sugar manifested as increment in sugar percentage (Alvi *et al.,* 2026; Brunda et al., 2026; Mandal et al., 2025). However, among the treatments used, it was found that fruits coated with shellac 5% enriched with 0.02mM SNP (T_6) had delayed accumulation of total sugar (16.87%) at 12 DAS compared with control (12.87%). Total sugar content dropped in other treatments except T_6, T_7 and T_8 at 12 DAS due to senescence. Shellac, wax and other pectin based edible coatings were reported to bring down the metabolic activity in stored fruits and slowed ripening, due to which conversion of starch and other carbohydrate to soluble sugar used to get delayed (Singh et al., 2026). Conversion of starch to sugar delayed due to SNP as for its activity of ethylene inhibitor to delay ripening of stored fruit (Chandini *et al.,* 2026). Certainly, it is therefore though in the present experiment that synergistic effect of shellac edible coating enriched with NO donor SNP had significantly delayed ripening manifested by slow rate of metabolic conversion of starch to soluble sugar. Therefore, caused delayed accumulation and better retention of total sugars in stored sapota fruits.

Ascorbic Acid, total phenol and antioxidant activity of sapota in storage

Storing of the sapota in ambient condition had significantly reduced the ascorbic acid as well as total phenol content. It was found that at 3 DAS, ascorbic acid content was ranged between 12.57 to 16.78 mg $100g^{-1}$, but at 12 DAS, it declined and ranged between 4.32 to 10.32 mg $100g^{-1}$(Table 4). On the other hand, total phenol was ranged between 0.51 to 0.94 mg CEg^{-1} at 3 DAS but reduced and ranged between 0.12 to 0.35 mg CEg^{-1} at 12 DAS. Brunda *et al.* (2026) observed similar reduction in ascorbic acid and total phenol content in stored sapota due to oxidative reactions and rapid metabolic changes in relation to fruit senescence. It was found in present experiment that application of SNP (0.02mM) + shellac coating (5%) had maintained reasonably high ascorbic acid (10.32 mg $100g^{-1}$) and total phenol (0.35 mg CE g^{-1}) content compared with control (ascorbic acid: 4.32 mg $100g^{-1}$, total phenol: 0.12 mg CE g^{-1}) at 12 DAS. Jan *et al.* (2026) reported that SNP when applied with surface coating like chitosan can hinder the rate of metabolic development of Reactive Oxygen Species (ROS) and oxygen penetration in fruit, consequently gave better retention of ascorbic acid in plum which otherwise get faster oxidation to covert as dehydro- ascorbic acid. Kanaujia *et al.* (2025) found that application of SNP significantly reduced the loss of phenolic constituents by lowering the activity of peroxidase, poly phenol oxidase and phenylalanine ammonia lyase enzymes responsible for oxidative denaturation of total phenol in stored fruits. Edible coatings are reported to reduce gas diffusion rate and therefore better retained the ascorbic acid and total phenol in stored fruit, which are uncoated (Kunhilintakath and Chengaiyan, 2025).

Study on the antioxidant activity of the stored sapota depicted that fruits coated with shellac (5%) enriched with SNP (0.02-0.05 mM) had retained higher antioxidant activity (68.58 to 76.97 % inhibition DPPH) compared with control (16.52 % inhibition DPPH) (Table 4). As the SNP+ shellac coated fruit retained higher ascorbic acid and total phenolics, consequently antioxidant activity was found higher on such treatments. Jan *et al.* (2026) opined that SNP along with chitosan edible coating had retained better antioxidant activity in stored plum as it hindered the oxidative stress progression, combated cell wall degradation along with imparting anti-senescence effect.

CONCLUSION

From the present experiment, it was evident that composite coating of fruits with sodium nitroprusside @ 0.02mM and shellac @5% resulted in maximum extension of shelf life by delaying the fruit ripening with good maintenance of physico-chemical qualities and fruit decay. Fruits at this treatment delayed in accumulation TSS, while maintaining firmness, controlling weight loss and preserving better phenolics and ascorbates. Therefore, it may be concluded that, ambient storage time of sapota may be enhanced with application of composite coating with SNP (0.02mM) and shellac (5%).

CONFLICT OF INTEREST STATEMENT

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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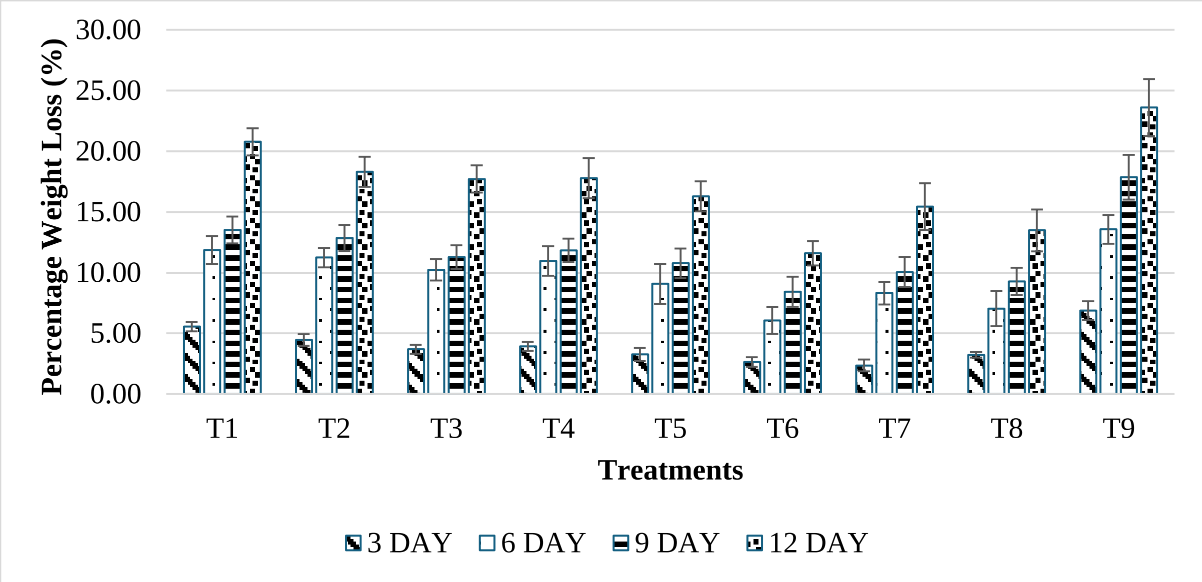

Figure 1. Percent weight loss of stored sapota in storage under different postharvest treatments with SNP & shellac
(T1: SNP 0.02mM, T2: SNP 0.05mM, T3: SC 2%, T4: SC 5%, T5:0.02mM SNP+ SC 2%, T6:0.02mM SNP+ SC 5%, T7:0.05mM SNP+ SC 2%, T8:0.05mM SNP+ SC 5%, T9: Control)

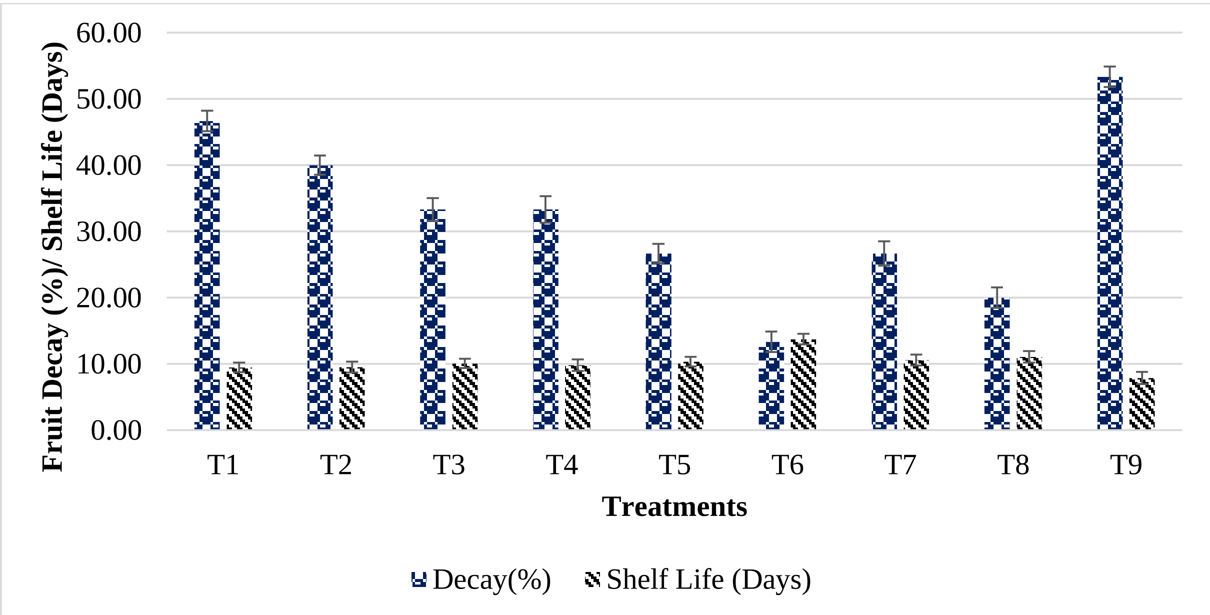

Figure 2. Fruit decay and shelf life of sapota fruits in storage under different postharvest treatments with SNP & shellac
(T1: SNP 0.02mM, T2: SNP 0.05mM, T3: SC 2%, T4: SC 5%, T5:0.02mM SNP+ SC 2%, T6:0.02mM SNP+ SC 5%, T7:0.05mM SNP+ SC 2%, T8:0.05mM SNP+ SC 5%, T9: Control)

Table 1: Effect of SNP and shellac coating treatments on fruit firmness and pulp colour of sapota in storage

Treatments	Fruit firmness (Ncm^{-2})				Pulp colour at 12 DAS		
	3DAS	6DAS	9DAS	12DAS	L	a	b
T_1: 0.02mM SNP	66.57b	51.28b	26.78a	8.97ab	49.52	8.85	14.83
T_2: 0.05 mM SNP	68.69b	56.72c	38.59b	12.43b	47.12	7.16	17.26
T_3: 2% Shellac Coating	75.58cd	68.52e	53.61de	20.28cd	66.44	8.01	16.67
T_4: 5% Shellac Coating	72.67c	60.75d	45.63c	18.32c	57.92	7.45	19.71
T_5: 0.02mM SNP + 2% Shellac Coating	77.43d	62.43d	48.92cd	21.78cde	64.08	8.62	29.33
T_6: 0.02mM SNP + 5% Shellac Coating	85.92f	78.35g	62.64f	29.39f	61.89	-2.31	23.21
T_7: 0.05mM SNP + 2% Shellac Coating	78.91de	73.66f	59.17f	24.35def	62.85	5.04	29.68
T_8: 0.05mM SNP + 5% Shellac Coating	82.35ef	70.37ef	57.46ef	26.89ef	67.37	-3.17	22.55
T_9: Control	62.46a	47.38a	23.58a	4.87a	53.68	9.22	21.81
S Em (±)	1.219	1.236	1.672	1.702	-	-	-
CD at 5%	1.725	1.749	2.368	2.410	-	-	-

Means followed by the same letters do not differ significantly at P=0.05 level of probability; DAS: Days after storage

Table 2: Effect of SNP and shellac coating treatmentson total soluble solids (TSS) and titrable acidity content of sapota fruits in storage

Treatments	TSS (^{0} Brix)				Titrable Acidity (%)			
	3DAS	6DAS	9DAS	12DAS	3DAS	6DAS	9DAS	12DAS
T_1: 0.02mM SNP	14.78b	17.36ef	18.48cd	14.95a	0.19a	0.17ab	0.14ab	0.09ab
T_2: 0.05 mM SNP	13.42b	16.75ef	18.05cd	15.29ab	0.23ab	0.18ab	0.15abc	0.10abc
T_3: 2% Shellac Coating	10.82a	15.34cde	17.23bc	16.65abc	0.24abc	0.21abc	0.18acde	0.14cde
T_4: 5% Shellac Coating	11.56a	16.05def	17.68cd	16.32ab	0.22ab	0.19abc	0.16abcd	0.12bcd
T_5: 0.02mM SNP + 2% Shellac Coating	10.35a	13.78bcd	16.47bc	15.52ab	0.25abc	0.20abc	0.19cde	0.15de
T_6: 0.02mM SNP + 5% Shellac Coating	9.56a	10.82a	13.25a	18.86c	0.32c	0.26c	0.22e	0.17e
T_7: 0.05mM SNP + 2% Shellac Coating	9.92a	13.16abc	15.39b	17.23abc	0.27abc	0.23bc	0.20cde	0.16de
T_8: 0.05mM SNP + 5% Shellac Coating	9.78a	12.35ab	15.24b	17.67bc	0.29bc	0.24bc	0.21de	0.16de
T_9: Control	16.87c	18.48f	19.56d	14.85a	0.19a	0.15a	0.13a	0.06a
S Em (±)	0.603	0.753	0.650	0.728	0.025	0.021	0.015	0.013
CD at 5%	0.854	1.066	0.920	1.030	0.035	0.030	0.022	0.019

Means followed by the same letters do not differ significantly at P=0.05 level of probability; DAS: Days after storage

Table 3: Effect of SNP and shellac coating treatments on TSS:acid ratio and total sugar content of sapota fruits in storage

Treatments	TSS:acid ratio				Total Sugar (%)			
	3DAS	6DAS	9DAS	12DAS	3DAS	6DAS	9DAS	12DAS
T_1: 0.02mM SNP	77.79f	102.12f	142.15f	166.11e	12.96ef	16.34ef	17.01d	13.05ab
T_2: 0.05 mM SNP	58.35e	93.06e	120.33e	152.90d	11.87de	15.43ef	16.96d	13.28ab
T_3: 2% Shellac Coating	45.08cd	73.05c	95.72c	118.93b	9.78bc	14.21cde	15.98bcd	14.39abcd
T_4: 5% Shellac Coating	52.55de	84.47d	110.50d	136.00c	10.32cd	15.09def	16.57cd	14.09abc
T_5: 0.02mM SNP + 2% Shellac Coating	41.40bc	68.90c	86.68c	103.47a	9.56bc	12.98bcd	15.32bcd	14.63abcd
T_6: 0.02mM SNP + 5% Shellac Coating	29.88a	41.62a	60.23a	110.94ab	7.14a	9.09a	11.56a	16.87d
T_7: 0.05mM SNP + 2% Shellac Coating	36.74abc	57.22b	76.95b	107.69ab	8.96abc	12.56bc	14.28bc	15.45bcd
T_8: 0.05mM SNP + 5% Shellac Coating	33.72ab	51.46b	72.57b	110.44ab	8.09ab	11.45b	13.87b	15.98cd
T_9: Control	88.79g	123.20g	150.46f	247.50f	15.21f	16.78f	17.23d	12.87a
S Em (±)	2.760	2.868	3.125	4.057	0.667	0.742	0.735	0.749
CD at 5%	3.908	4.061	4.425	5.743	0.944	1.051	1.040	1.060

Means followed by the same letters do not differ significantly at P=0.05 level of probability; DAS: Days after storage

Table 4: Effect of SNP and shellac coating treatmentson ascorbic acid, total phenol content and antioxidant activity of sapota fruits in storage

Treatments	Ascorbic acid (mg100 g^{-1})				Total phenol (mg CEg^{-1})				Antioxidant activity (% inhibition DPPH)
	3DAS	6DAS	9DAS	12DAS	3DAS	6DAS	9DAS	12DAS	12DAS
T_1: 0.02mM SNP	13.15ab	10.86a	7.85ab	5.63ab	0.58ab	0.45ab	0.31ab	0.18ab	26.78b
T_2: 0.05 mM SNP	13.12ab	11.24ab	8.78abc	6.83bc	0.62ab	0.47abc	0.38abc	0.20abc	33.28c
T_3: 2% Shellac Coating	14.34ab	11.98abc	9.87bcde	8.52d	0.68abc	0.62cde	0.43abcd	0.25bcd	59.54de
T_4: 5% Shellac Coating	13.67ab	11.62ab	9.23abcd	8.16cd	0.64ab	0.58bcd	0.41abcd	0.21bc	56.28d
T_5: 0.02mM SNP + 2% Shellac Coating	14.87bc	12.92ab	10.73cde	8.86de	0.72bc	0.65de	0.48bcd	0.28cde	61.07de
T_6: 0.02mM SNP + 5% Shellac Coating	16.78c	15.45d	11.78e	10.32e	0.94d	0.84f	0.62d	0.35e	76.97g
T_7: 0.05mM SNP + 2% Shellac Coating	15.09bc	13.12bc	11.09de	9.26de	0.78bcd	0.72def	0.52bcd	0.30de	64.58ef
T_8: 0.05mM SNP + 5% Shellac Coating	15.23bc	13.78cd	10.23cde	9.56de	0.87cd	0.78ef	0.56cd	0.32de	68.58f
T_9: Control	12.57a	10.63a	7.48a	4.32a	0.51a	0.38a	0.25a	0.12a	16.52a
S Em (±)	0.674	0.611	0.670	0.515	0.063	0.053	0.065	0.027	1.805
CD at 5%	0.954	0.865	0.948	0.730	0.089	0.074	0.092	0.038	2.556

Means followed by the same letters do not differ significantly at P=0.05 level of probability; DAS: Days after storage; CE: Catechin equivalent; DPPH: 2,2-diphenyl-1-picrylhydrazyl