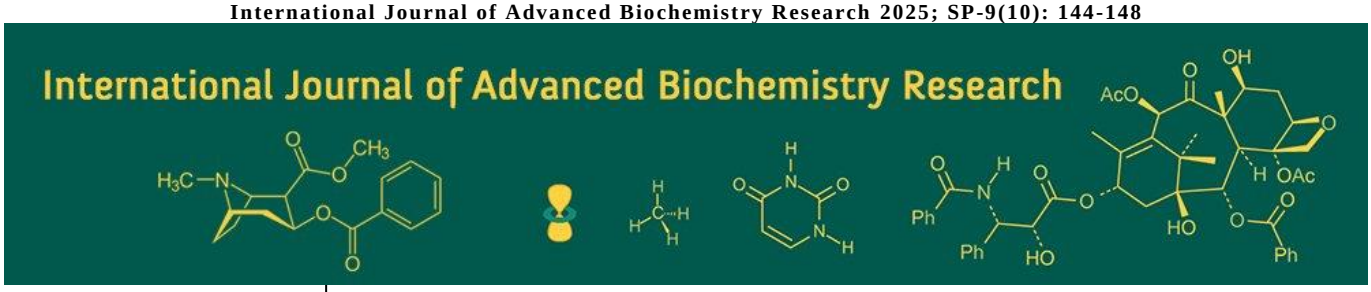

ISSN Print: 2617-4693
ISSN Online: 2617-4707
NAAS Rating (2025): 5.29
IJABR 2025; SP-9(10): 144-148
www.biochemjournal.com
Received: 02-08-2025
Accepted: 06-09-2025

Shivani Sahu
M.Sc. Scholar, Department of Fruit Science, College of Horticulture and Research Station, MGUVV, Durg, Chhattisgarh, India

Johnson Lakra
Assistant Professor, Department of Fruit Science, College of Horticulture and Research Station, MGUVV, Durg, Chhattisgarh, India

Purnendra Kumar Sahu
Assistant Professor, Department of Fruit Science, College of Horticulture and Research Station, MGUVV, Durg, Chhattisgarh, India

Manisha Kashyap
Assistant Professor, Department of (Floriculture & Landscape Architecture), College of Horticulture and Research Station, MGUVV, Durg, Chhattisgarh, India

Namita Singh
Assistant Professor, Department of Genetics and Plant Breading, College of Horticulture and Research Station, MGUVV, Durg, Chhattisgarh, India

Corresponding Author:
Shivani Sahu
M.Sc. Scholar, Department of Fruit Science, College of Horticulture and Research Station, MGUVV, Durg, Chhattisgarh, India

Effect of different types of packaging materials to improve shelf life and quality of banana (*Musa paradisiaca* L.) cv. G-9

Shivani Sahu, Johnson Lakra, Purnendra Kumar Sahu, Manisha Kashyap and Namita Singh

DOI: https://www.doi.org/10.33545/26174693.2025.v9.i10Sb.5828

Abstract
The experiment was conducted using healthy, uniform, and physiologically mature banana fruits (cv. Grand Naine) at the green stage, Packaging treatments included brown paper bags, gunny bags, and LDPE films (51 µm) in combination with silica gel sachets (1 g, 2 g, and 3 g). Fruits were stored under ambient/controlled conditions, with temperature and relative humidity monitored using a digital thermometer and hygrometer data logger. Physiological parameters such as fruit weight loss, spoilage, and quality attributes (TSS, pH, sugars, ascorbic acid) were periodically assessed using standard laboratory instruments.

Keywords: Banana, packaging, silica gel, storage, PLW, quality

Introduction
Banana (*Musa paradisiaca* L.), a member of the Musaceae family, is one of the most important fruit crops cultivated in tropical and subtropical regions due to its high nutritional value, economic importance, and year-round availability. It is a rich source of carbohydrates, dietary fiber, vitamins (A, B-complex, C), and minerals like potassium, magnesium, and phosphorus, making it a functional food suitable for all age groups (Mohapatra, 2009) [7]. In India, popularly known as the "poor man's apple," banana is consumed fresh, processed into chips, puree, flour, wine, and other products, or used as a vegetable in its immature stage. Besides the fruit, the pseudo stem, leaves, and fibers are widely utilized, thereby enhancing the plant's economic value and reducing waste (Mohapatra, 2009) [7]. Regular consumption of banana has been linked with health benefits such as blood pressure regulation, reduced risk of cardiovascular disorders, and improved digestive health. Owing to its wide adaptability, consumer preference, and industrial applications, banana also holds significant potential for export markets.

Materials and Methods
Physiological parameters
Physiological Loss in Weight (PLW %)
Physiological loss in weight was determined by recording the initial fruit weight and subsequent weight at 3-day intervals during storage (0, 3, 6, 9, 12, and 15 DAS). The percentage loss in weight was calculated using the following formula:

$$PLW\ (\%) = \frac{W1-W2}{W1} \times 100$$

Fruit Weight (g)
Average fruit weight was recorded at each observation interval using a digital weighing balance with 0.01 g precision. Ten fruits per replication were weighed, and the mean value was expressed in grams (g).

Spoilage (%)
Spoiled fruits were identified based on visible fungal infection, discoloration, and unmarketable appearance. Spoilage percentage was calculated as:

$$\text{Spoilage (\%)} = \frac{\text{Total number of fruits}}{\text{Number of spoiled fruits}} \times 100$$

Shelf Life (days)
Shelf life was assessed based on the number of days fruits remained in acceptable marketable condition, judged by appearance, firmness, and consumer acceptability. The day on which 50% fruits in a treatment became unmarketable was considered as the end of shelf life.

Results and Discussion
Physical Parameters of Banana
The physical parameters of papaya fruits were recorded at 0, 3, 6, 9, 12, and 15 DAS for the following variables Fruit weight (g), Physiological loss in weight (%), Spoilage (%) and Shelf-life respectively.

Fruit weight
The fruit weight of banana decreased progressively from 0 DAS during the storage period across all treatments. The highest average fruit weight was recorded under T_9 (LDPE 51 micron + Silica gel Sachet 3g) with 905 g, followed by T_3 (Brown Paper + Silica gel Sachet 3g) with 895 g at 3 DAS. Other treatments recorded intermediate fruit weights, while the minimum weight was observed in T_0 (Control) with 702 g at 3 DAS. Fruits under some treatments were discarded at later storage intervals due to microbial spoilage or overripening, and no observations were recorded at 15 DAS.

Physiological loss in weight (%)
The physiological loss in weight (PLW) of banana fruits increased progressively during the storage period from 0 DAS to 15 DAS across all treatments. The minimum PLW was recorded under T_1 (Brown Paper + Silica gel Sachet 1 g) with 1.17% at 3 DAS, while the maximum PLW was observed in T_3 (Brown Paper + Silica gel Sachet 3 g) reaching 14.12% at 15 DAS. Treatments T_9 (LDPE 51 micron + Silica gel Sachet 3 g) and T_6 (Gunny bag + Silica gel Sachet 3 g) maintained lower PLW compared to control and other packaging methods, indicating their efficiency in reducing weight loss and delaying senescence.

Spoilage (%)
The spoilage of banana fruits increased progressively during storage from 3 DAS to 15 DAS across all treatments. The highest spoilage was observed in the control (T_0) reaching 55.68% at 15 DAS, whereas the lowest spoilage was recorded under T_9 (LDPE 51 micron + Silica gel Sachet 3 g) with 18.45% at 15 DAS, indicating better protection against microbial decay and delayed ripening. Treatments T_3 (Brown Paper + Silica gel Sachet 3 g) and T_5 (Gunny bag + Silica gel Sachet 2 g) showed intermediate spoilage levels, suggesting moderate efficacy in reducing fruit deterioration during storage.

Shelf-life
The shelf life of banana fruits varied significantly across different treatments. The shortest shelf life was observed in the control (T_0) with 8.05 days, indicating rapid ripening and spoilage. Among the treatments, T_9 (LDPE 51 micron + Silica gel Sachet 3 g) exhibited the longest shelf life of 14.80 days, demonstrating the effectiveness of the LDPE packaging combined with silica gel in delaying ripening and reducing postharvest losses. Treatments T_3 (Brown Paper + Silica gel Sachet 3 g) and T_8 (LDPE 51 micron + Silica gel Sachet 2 g) also showed extended shelf life of 14.15 and 14.25 days, respectively, while other treatments showed intermediate values ranging between 9.20 and 13.50 days. This indicates that both packaging type and the amount of silica gel influenced the storage longevity of banana fruits.

Table 1: Effect of different types of packaging materials to improve shelf life and quality of Banana (*Musa paradisiaca* L.) cv. G-9 in fruit weight.

Notations	Treatments		Fruit weight (g)				
		0 DAS	3 DAS	6 DAS	9 DAS	12 DAS	15 DAS
T_0	Control	710	702	693	683	672	660
T_1	Brown Paper + Silica gel Sachet (1g)	900	890	880	870	860	850
T_2	Brown Paper + Silica gel Sachet (2g)	800	792	783	774	765	756
T_3	Brown Paper + Silica gel Sachet (3g)	915	905	895	885	875	865
T_4	Gunny bag + Silica gel Sachet (1g)	720	712	703	695	685	675
T_5	Gunny bag + Silica gel Sachet (2g)	835	826	818	810	802	795
T_6	Gunny bag + Silica gel Sachet (3g)	880	870	861	852	844	835
T_7	LDPE (51 micron) + Silica gel Sachet (1g)	745	736	728	720	712	703
T_8	LDPE (51 micron) + Silica gel Sachet (2g)	905	895	886	877	868	860
T_9	LDPE (51 micron) + Silica gel Sachet (3g)	765	756	748	740	732	724
	SE (m)±		3.0	2.8	2.7	2.5	2.4
	C.D. at 5%		8.2	7.4	7.6	7.2	6.8

Table 2: Effect of different types of packaging materials to improve shelf life and quality of Banana (*Musa paradisiaca* L.) cv. G-9 in Physiological Loss in Weight%

Notations	Treatments		Physiological Loss in Weight%				
		0 DAS	3 DAS	6 DAS	9 DAS	12 DAS	15 DAS
T_0	Control	0.00	1.48	3.52	5.41	8.05	10.48
T_1	Brown Paper + Silica gel Sachet (1g)	0.00	1.17	2.54	4.06	6.03	8.21
T_2	Brown Paper + Silica gel Sachet (2g)	0.00	2.05	5.18	8.25	11.30	14.12
T_3	Brown Paper + Silica gel Sachet (3g)	0.00	1.33	2.89	4.63	7.01	9.48
T_4	Gunny bag + Silica gel Sachet (1g)	0.00	1.03	2.23	3.52	5.49	7.52
T_5	Gunny bag + Silica gel Sachet (2g)	0.00	1.62	3.77	5.95	8.65	11.10
T_6	Gunny bag + Silica gel Sachet (3g)	0.00	1.26	2.69	4.32	6.51	8.79
T_7	LDPE (51 micron) + Silica gel Sachet (1g)	0.00	1.57	3.38	5.18	7.85	10.32
T_8	LDPE (51 micron) + Silica gel Sachet (2g)	0.00	1.46	3.12	4.88	7.37	9.92
T_9	LDPE (51 micron) + Silica gel Sachet (3g)	0.00	1.39	3.21	4.97	7.53	9.95
	SE (m)±		3.0	2.8	2.7	2.5	2.4
	C.D. at 5%		8.2	7.4	7.6	7.2	6.8

Table 3: Effect of different types of packaging materials to improve shelf life and quality of Banana (*Musa paradisiaca* L.) cv. G-9 in Spoilage (%)

Notations	Treatments		Spoilage (%)				
		0 DAS	3 DAS	6 DAS	9 DAS	12 DAS	15 DAS
T_0	Control	0.00	5.12	14.35	26.42	39.55	55.68
T_1	Brown Paper + Silica gel Sachet (1g)	0.00	3.45	9.28	18.56	27.43	39.24
T_2	Brown Paper + Silica gel Sachet (2g)	0.00	2.95	8.17	16.38	24.10	34.82
T_3	Brown Paper + Silica gel Sachet (3g)	0.00	2.65	7.82	15.25	22.38	32.14
T_4	Gunny bag + Silica gel Sachet (1g)	0.00	3.85	10.16	19.75	29.68	41.53
T_5	Gunny bag + Silica gel Sachet (2g)	0.00	3.22	8.85	17.65	26.42	36.48
T_6	Gunny bag + Silica gel Sachet (3g)	0.00	2.95	8.14	16.05	24.75	34.25
T_7	LDPE (51 micron) + Silica gel Sachet (1g)	0.00	2.48	6.32	12.46	18.68	26.34
T_8	LDPE (51 micron) + Silica gel Sachet (2g)	0.00	1.92	4.86	9.28	13.85	20.68
T_9	LDPE (51 micron) + Silica gel Sachet (3g)	0.00	1.58	4.12	7.95	11.82	18.45
	SE (m)±		0.31	0.42	0.56	0.71	0.16
	C.D. at 5%		0.92	1.26	1.68	2.12	0.48

Table 4: Effect of different types of packaging materials to improve shelf life and quality of Banana (*Musa paradisiaca* L.) cv. Shelf Life (Days)

Treatment	Shelf Life (Days)
T_0 (Control)	8.05
T_1 (Brown Paper + Silica gel Sachet 1g)	9.20
T_2 (Brown Paper + Silica gel Sachet 2g)	12.75
T_3 (Brown Paper + Silica gel Sachet 3g)	14.15
T_4 (Gunny bag + Silica gel Sachet 1g)	12.95
T_5 (Gunny bag + Silica gel Sachet 2g)	13.50
T_6 (Gunny bag + Silica gel Sachet 3g)	12.40
T_7 (LDPE 51 micron + Silica gel Sachet 1g)	13.10
T_8 (LDPE 51 micron + Silica gel Sachet 2g)	14.25
T_9 (LDPE 51 micron + Silica gel Sachet 3g)	14.80
SE(m)±	0.21
CD (5%)	0.62

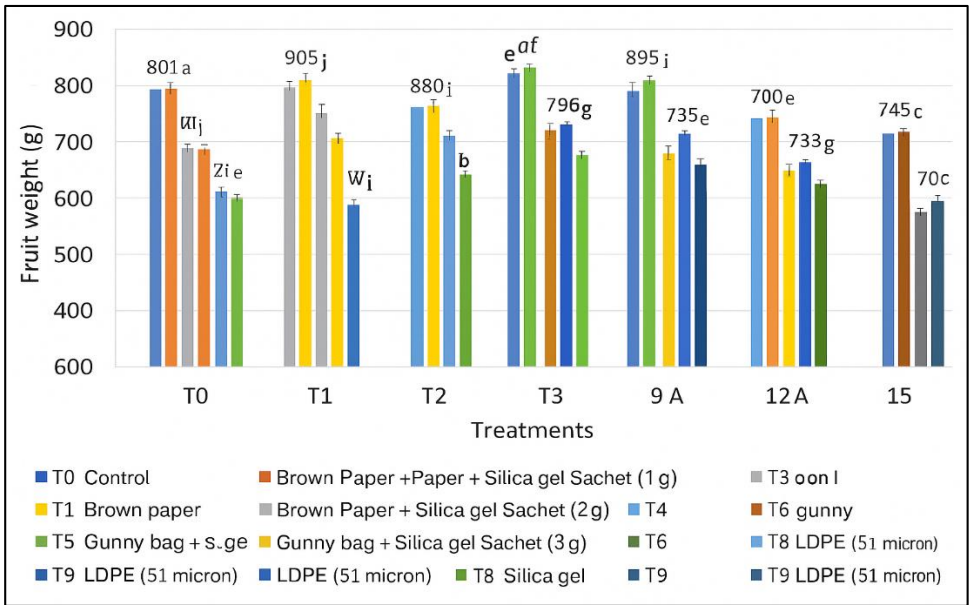

Fig 1: Effect of different types of packaging materials to improve shelf life and quality of Banana (*Musa paradisiaca* L.) cv. G-9 in fruit weight

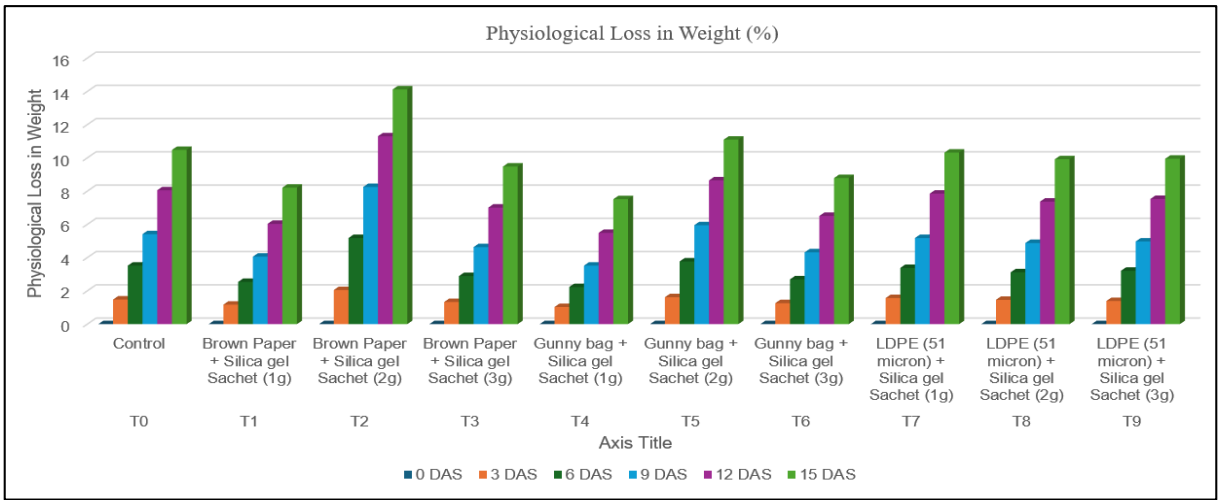

Fig 2: Effect of different types of packaging materials to improve shelf life and quality of Banana (*Musa paradisiaca* L.) cv. G-9 in Physiological Loss in Weight%

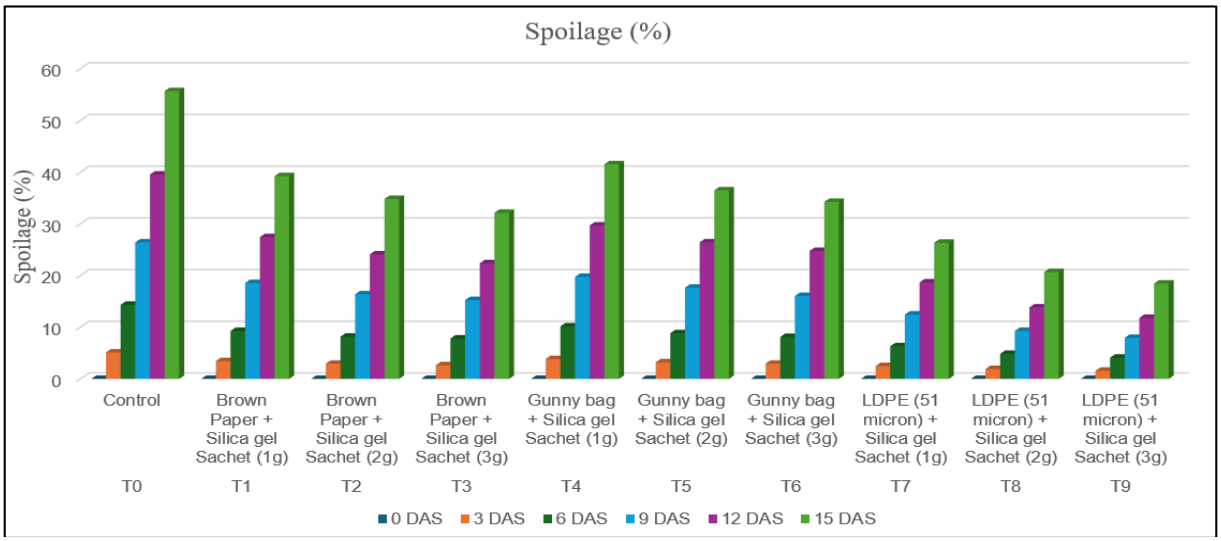

Fig 3: Effect of different types of packaging materials to improve shelf life and quality of Banana (*Musa paradisiaca* L.) cv. G-9 in Spoilage (%)

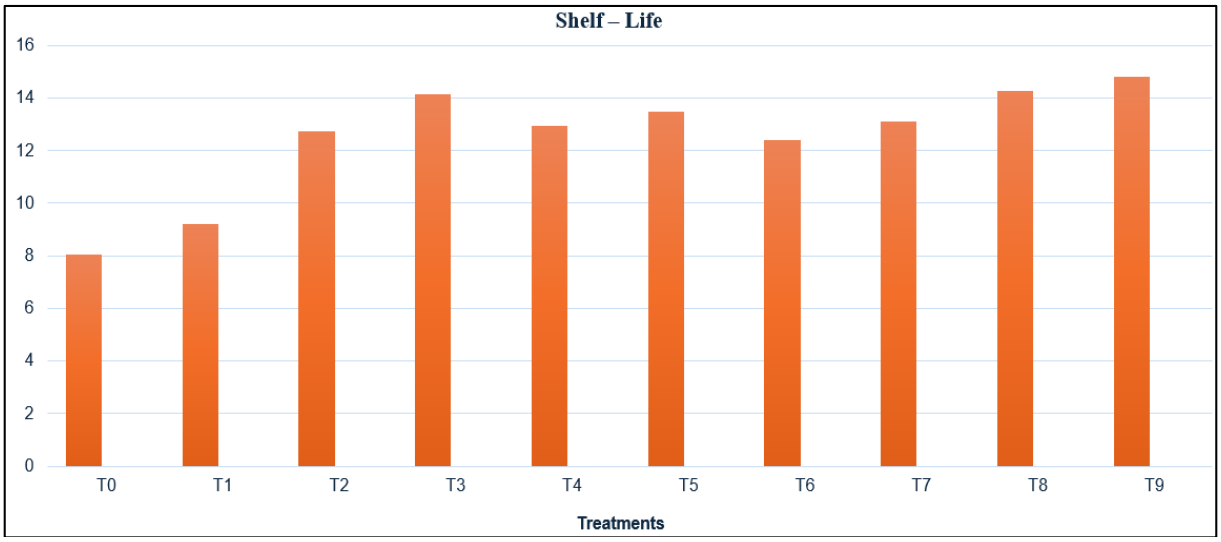

Fig 4: Effect of different types of packaging materials to improve shelf life and quality of Banana (*Musa paradisiaca* L.) cv. Shelf Life (Days)

Conclusion

The present study demonstrated that post-harvest treatments significantly influenced the quality, spoilage, physiological loss in weight (PLW), and shelf life of banana fruits during ambient storage. Among the evaluated treatments, T_9 (LDPE 51 micron + Silica gel Sachet 3 g) consistently performed the best, maintaining higher fruit weight, minimizing PLW, and reducing spoilage throughout the storage period. This treatment effectively extended the shelf life of banana fruits up to 14.80 days, compared to the control (T_0) which had the shortest shelf life of 8.05 days.

The application of LDPE packaging in combination with an optimal amount of silica gel was particularly effective in delaying ripening, reducing microbial decay, and maintaining banana firmness and marketability. Treatments like T_3 (Brown Paper + Silica gel Sachet 3 g) and T_8 (LDPE 51 micron + Silica gel Sachet 2 g) also exhibited extended shelf life, but were slightly less effective than T_9.

Overall, the results indicate that appropriate packaging coupled with moisture-absorbing agents can significantly reduce post-harvest losses, preserve fruit quality, and enhance the commercial viability of banana fruits. The findings suggest that LDPE packaging combined with silica gel is a promising approach for commercial storage and transportation of bananas under ambient conditions.

References

1. Bhatia K, Asrey R, Jha SK, Singh S, Kannaujia PK. Influence of packaging material on quality characteristics of minimally processed Mridula pomegranate (*Punica granatum*) arils during cold storage. Indian J Agric Sci. 2013;83(8):872-876.
2. Hewett EW. An overview of pre-harvest factors influencing postharvest quality of horticultural products. Int J Postharvest Technol Innov. 2006;1:4-15.
3. Kitinoja L, Kader AA. Small-scale postharvest handling practices: A manual for horticultural crops. 3rd ed. Davis (CA): University of California; 2013.
4. Kumar P, Mishra HN, Rai RD. Postharvest management of banana using biodegradable coatings and packaging materials: A review. J Food Sci Technol. 2021;58(10):3690-3702.
5. Kumari R, Kumari N, Panja P. Effect of packaging materials with ethylene absorbents on quality of banana fruits cv. Martaman (*Musa* spp.). Int J Curr Microbiol Appl Sci. 2017;6(12):1916-1924.
6. Mebratie MA, Woldetsadik K, Ayalew A, Haji J. Influence of packaged transportation on shelf life and quality of banana (*Musa* spp.) fruits. J Postharvest Technol. 2016;4(1):6-15.
7. Mohapatra D. Studies on the effect of packaging materials on shelf life. Stewart Postharvest Rev. 2009;5(5):1-11.
8. Santos O. Ripening and shelf life of 'BRS Caipira' banana fruit stored under room temperature or refrigeration. Cienc Rural. 2014;44(4):734-739.
9. Patel RK, Singh A, Yadav DS, Bhuyan M, Deka BC. Waxing, lining and polyethylene packaging on shelf life and juice quality of passion fruit during storage. J Food Sci Technol. 2009;46(1):70-75.
10. Ahmad S, Nasir MA. Effect of fruit size and temperature on the shelf life and quality of ripe banana fruit. Sarhad J Agric. 2007;23(1):25-30.
11. Sharma R, Verma S, Singh P. Effect of modified atmosphere packaging on postharvest quality of banana. Indian J Hortic. 2020;77(1):55-60.
12. Shewfelt RL. Measuring quality and maturity. In: Prussia SE, editor. Postharvest handling: A systems approach. London: Academic Press; 2009. p. 461-481.
13. Simmonds SNW. Harvest, transport and ripening bananas. 2nd ed. London: Longman Green and Co.; 1966. p. 205-247.
14. Singh A, Nath A, Buragohain J, Deka BC. Quality and shelf life of strawberry fruits in different packages during storage. J Food Sci Technol. 2008;45(5):439-442.