



International Journal of Horticulture and Food Science

E-ISSN: 2663-1067

P-ISSN: 2663-1075

NAAS Rating (2026): 4.74

www.hortijournal.com

IJHFS 2026; 8(9): 19-23

Received: 05-07-2026

Accepted: 07-08-2026

Dr. LV Pimpalpal

Assistant Professor,
Department of Horticulture,
Sanjeevane Mahavidyalaya,
Chapoli, Swami Ramanand
Teerth Marathwada
University, Nanded,
Maharashtra, India

Dr. MM Dhang

Assistant Professor,
Department of Agrochemicals
and Fertilizers,
Sanjeevane Mahavidyalaya,
Chapoli, Swami Ramanand
Teerth Marathwada
University, Nanded,
Maharashtra, India

Dr. BK Ghule

Assistant Professor,
Department of Dairy Science,
Sanjeevane Mahavidyalaya,
Chapoli, Swami Ramanand
Teerth Marathwada
University, Nanded,
Maharashtra, India

Corresponding Author:

Dr. LV Pimpalpal

Assistant Professor,
Department of Horticulture,
Sanjeevane Mahavidyalaya,
Chapoli, Swami Ramanand
Teerth Marathwada
University, Nanded,
Maharashtra, India

An interaction effect of chemical treatments and temperature on shelf life of dragon fruit (*Hylocereus Polyrhizus*)

LV Pimpalpal, MM Dhang and BK Ghule

DOI: <https://www.doi.org/10.33545/26631067.2026.v8.i9a.847>

Abstract

This study entitled “Effect of 1-MethylCyclopropene and Chitosan Treatments on Shelf life of Dragon Fruit (*Hylocereus polyrhizus*)” was carried out at Department of Horticulture, Sanjeevane Mahavidyalaya Chapoli Taluka Chakur Dist. Latur (M.S.) to determine the effects of postharvest chemicals 1-Methylcyclopropene and Chitosan when subjected to different storage temperature on the physiological, biochemical and antioxidant parameters of dragon fruit during long term storage. Dragon fruit, a highly perishable tropical fruit, is gaining popularity due to its attractive appearance, nutritional richness, and antioxidant potential. However, it has limited postharvest shelf-life because of its rapid physiological degradation, and sensitivity to chilling injury when stored under cold conditions. Thus quality, prolonged shelf life, and minimized postharvest losses are of greater importance as far as storage is concerned or as far as chemical treatment. The experiment was designed as a Factorial Completely Randomized Design (CRD) in two factors as (i) chemical treatments and (ii) storage temperature. These chemical treatments were cross tested with three storage temperatures of 50 C, 70 C and ambient temperature. The measurements were taken at 0, 8, 16, 24, 32 and 40 days of storage to evaluate the physiological loss in weight (PLW), Respiration rate, Ethylene evolution, Firmness and Decay, Shelf life, Chromaticity (L^* , a^* , b^*), Total Soluble Solids (TSS), Titratable acidity (TA), Total sugar, reducing sugar, Betacyanin content, Total phenols, Flavonoids, CUPRAC, and FRAP antioxidant capacities. The findings showed that the individual and interactive effects of chemicals and storage temperature were significantly affecting all the measured parameters in the course of storage. Chilling injury is a major physiological disorder in the tropical fruit under low-temperature storage; this was most successfully minimized in T14 where a lower concentration of Chitosan 2% was applied at 7°C. The lowest chilling injury was observed in this treatment during storage which implies the protective effect of Chitosan 2% in reducing cold stress. 1-MCP treated fruits had the minimum ethylene evolution, vital in retarding fruit ripening and senescence, and the maximum FRAP value, therefore, indicating superior antioxidant defense mechanism under low-temperature stress.

Keywords: Dragon fruit; *hylocereus polyrhizus*; 1-methylcyclopropene (1-mcp); chitosan; storage temperature; shelf life; postharvest treatment; chilling injury; antioxidant activity; ethylene evolution; fruit quality; physiological loss in weight

Introduction

The pitaya fruit, also known as pitahaya, is a popular member of the Cactaceae family and is grown extensively in tropical and subtropical regions (Huang *et al.*, 2021). Native to Mexico and Central America, pitaya fruit (*Hylocereus*) is also known as dragon fruit (Utpott *et al.*, 2020) [8]. The food industry is interested in using pitaya fruit as a cost-effective, eco-friendly, plant-based, and clean-label ingredient because of its high nutritional content (Jeronimo *et al.*, 2017) [3]. The three main types of carbohydrates found in red pitaya are glucose, fructose, and oligosaccharides (Wichienchot *et al.*, 2010) [9]. Furthermore, polysaccharides and polyphenols are well-known antioxidants that can be added to food products as natural colorants (betanin) and prebiotic enrichment (Khuituan *et al.*, 2019 and kim *et al.*, 2011) [6]. According to reports, essential fatty acids particularly linoleic acid extracted from pitaya seeds have laxative properties for gastroenteritis (Zulkifli *et al.*, 2020) [11]. Farmers in the Indian states of Karnataka, Kerala, Tamil Nadu, Maharashtra, Gujarat, Orissa, West Bengal, Andhra Pradesh and Andaman & Nicobar Islands have already taken up its cultivation, and the estimated total area under Dragon fruit cultivation in these regions may be less than 400

ha. Majority of the dragon fruits presently available in Indian markets are imported from Vietnam, Thailand, Malaysia and Sri Lanka. Rapid shrivelling of the fruit also affects its marketability, storage life, and visual quality (Jiang *et al.*, 2002) [4]. Because weight loss and desiccation from transpiration diminish the fruit's shelf life as soon as it separates from the plant, efforts must be made to delay transpiration (Ariffin *et al.*, 2009) [1]. On the other hand, fruits exposed to high relative humidity may be more prone to deterioration (Shin *et al.*, 2007) [7].

Materials and Methods

The present investigation was carried out to Study effect of chemicals and temperature on storage life and quality of Dragon fruit with the objectives,

to estimate biochemical profile of Dragon fruit, to study the effect of chemicals and temperature on storage life of Dragon fruit and to assess the effect of chemicals and temperature on quality of Dragon fruit.

1-MCP

1-Methylcyclopropene is marketed under the trade name of Smartfresh in the form of powder. The chemical was weighed of 1000 ppb and 1500 ppb, then each mixed with Luke warm water of 2ml which were exposed under the closed container for 12 hours, and

container is sealed with plastic tape.

Chitosan

Formulation of chitosan 2% and 4% was prepared with 1% acetic acid to accelerate the dissolution process. Fruits were dipped coated by immersion in the coating solutions for 2 minutes, drained of excess coating and air dried in the room under fan.

Results and Discussion

The experiment was undertaken on “Effect of 1-MethylCyclopropene and Chitosan Treatments on Shelf life of Dragon Fruit (*Hylocereus polyrhizus*).” with an objective to estimate biochemical profile of Dragon fruit, to study the effect of chemicals and temperature on storage life of Dragon fruit, to assess the effect of chemical and temperature on quality of dragon fruit. The observations were carried out regarding chemical parameters like TSS, acidity, reducing sugars, non-reducing sugars, total sugars and ascorbic acid, chemical analysis and sensory evaluation of treated dragon fruit were conducted at preparation and after every 8 days of interval up to 40 days of storage at three different temperatures.

Effect of 1-MCP, Chitosan and temperature on physiological loss in weight of dragon fruit

Table 1: Effect of chemical treatments and storage temperature on dragon fruit during storage.

Chemicals	0 Days	8 Days	16 Days	24 Days	32 Day	40 Days
1000ppb 1- MCP	4.505	4.063	1.320	0.999	1.041	1.239
1500ppb 1- MCP	3.159	3.463	1.814	0.849	1.093	1.053
Chitosan 2%	0.881	0.864	0.403	0.772	1.656	1.627
Chitosan 4% (4%)	2.441	2.083	1.234	3.023	4.102	1.996
SE (m)±	0.057	0.027	0.010	0.031	0.004	0.021
CD at 5%	0.168	0.080	0.031	0.090	0.010	0.061
Temperature						
S1(5°C)	0.325	0.280	0.726	1.673	2.417	1.895
S2(7°C)	0.415	0.328	0.881	1.773	2.542	1.701
S3(control)	6.114	5.738	0.886	0.000	0.000	0.000
SE (m)±	0.035	0.017	0.006	0.019	0.002	0.013
CD at 5%	0.103	0.049	0.019	0.055	0.006	0.037

The physiological loss in weight of dragon fruit was gradually decreased in temperature 40 days of storage which is presented in table 1.1. The effect of chemicals and temperature on PLW content at 0 days of storage condition was found significant. At 0 days of storage minimum PLW was found in chitosan 2% (0.881). The results were also found significant at 8,16,24,32 and 40 days of storage. At 8th day of storage minimum PLW was recorded in treatment chitosan 4% (2.44%) and was found superior to (3.159%)

and at par with each other. Similar trend was found in 16th day of storage where minimum PLW recorded. At 24, 32 and 40th day of storage minimum PLW observed in chitosan 2% (0.772%) and was significantly superior to all other treatments.

Interaction effect of chemicals and temperature on Respiration rate of dragon fruit

Table 2: Effect of chemical treatments and storage temperature on TSS of dragon fruit

Chemicals	0 Days	8 Days	16 Days	24 Days	32 Days	40 Days
1000ppb 1- MCP	12.738	12.660	7.155	7.045	6.852	6.785
1500ppb 1- MCP	11.775	11.667	7.317	7.258	7.140	7.215
Chitosan 2%	12.368	12.297	7.868	7.612	7.440	7.183
Chitosan 4%	12.212	12.183	8.378	8.245	7.975	7.583
SE (m)±	0.0060	0.061	0.007	0.008	0.007	0.009
CD at 5%	0.016	0.179	0.020	0.024	0.0210	0.025
Temperature						
S1(5°C)	12.076	11.999	11.315	11.073	10.781	10.416
S2(7°C)	12.756	12.682 1	11.708	11.413	11.091	10.799
S3(control)	11.303	11.321	0.000	0.000	0.000	0.000
SE (m)±	0.003	0.003	0.004	0.005	0.004	0.009
CD at 5%	0.010	0.037	0.012	0.015	0.013	0.015

The data representing the interaction effects of different chemicals and temperature on respiration rate of dragon fruit are presented in table 4.4 with graphical depiction in Fig. 1.2. An interaction effect of chemicals and temperature on respiration rate of dragon fruit was found significant at 0 to 40 days of storage. At 0 days maximum respiration rate was recorded in Chitosan 2% i.e. 12.368 ml under 7°C temperature storage. Co₂/Kg/h and was found significantly higher than all other treatments. At 40th day minimum respiration rate was recorded in Chitosan 2% i.e. 7.183ml.

Co₂/Kg/h and maximum respiration rate in Chitosan 4% treatment i.e. 7.583

ml. Co₂/Kg/h and found significantly higher than all other treatments and followed Fawole *et al.*, (2020) reported that Chitosan impact on other fruit quality variables during storage, respiration rate is a reliable measure of physiological activity. Fruit's apparent rise in respiration rate during storage may be a sign of increased stress, including the existence of physiological diseases.

Table 3: Effect of chemicals and temperature on ethylene evolution of dragon fruit

Chemicals	0 Days	8 Days	16 Days	24 Days	32 Days	40 Days
1000ppb 1-MCP	0.063	0.073	0.083	0.052	0.047	0.040
1500ppb 1-MCP	0.065	0.074	0.081	0.052	0.047	0.043
Chitosan 2%	0.064	0.076	0.081	0.049	0.040	0.035
Chitosan 4%	0.065	0.074	0.083	0.051	0.044	0.038
SE (m)±	0.000	0.000	0.001	0.000	0.000	0.000
CD at 5%	0.001	0.001	0.002	0.001	0.001	0.001
Temperature						
S1(5°C)	0.065	0.073	0.081	0.075	0.066	0.056
S2(7°C)	0.066	0.066	0.081	0.075	0.065	0.055
S3(control)	0.063	0.075	0.083	0.000	0.000	0.000
SE (m)±	0.000	0.000	0.000	0.000	0.000	0.000
CD at 5%	0.001	0.001	0.001	0.001	0.001	0.001

The ethylene evolution of dragon fruit was gradually decreased in all chemicals under study are presented in 1.3 Table. The effect of chemicals on ethylene evolution at 0 days of storage condition was found significant. At 0 days of storage condition significantly minimum ethylene evolution i.e. 0.063 ppm was found in 1000ppb 1-Methylcyclopropene treatment. However, the results were found significant at 8, 16, 24, 32 and 40 days of storage. At

40 days of storage minimum ethylene evolution was recorded in Chitosan 2% (0.035ppm). This was followed by the treatment Chitosan 4% (0.038 ppm). These effects may possibly be related to decreasing internal oxygen levels, which may lead to decreased rates of ethylene synthesis. It is likely that the decreased ethylene synthesis was caused by low oxygen levels linked to high chitosan coating concentrations reported by Jitareerat *et al.*, (2007) [5].

Table 4: Interaction effect of chemicals and temperature on the chilling injury of dragon fruit

Chemicals	8 Days	16 Days	24 Days	32 Days	40 Days
1000ppb 1-MCP	11.112	27.778	3.032	18.518	40.490
1500ppb 1-MCP	13.350	25.000	6.062	7.410	34.285
Chitosan 2%	13.333	27.270	6.067	18.518	33.350
Chitosan 4%	15.552	26.683	9.092	44.440	38.350
SE (m)±	0.006	0.008	0.005	0.004	0.013
CD at 5%	0.019	0.023	0.015	0.012	0.037
Temperature					
S1(5°C)	0.000	0.000	10.232	26.388	59.565
S2(7°C)	0.000	0.000	11.369	45.831	48.321
S3(control)	40.003	73.791	0.000	0.000	0.000
SE (m)±	0.004	0.005	0.003	0.003	0.008
CD at 5%	0.011	0.014	0.009	0.008	0.023

The data representing the interaction effects of different chemicals and temperature on chilling injury of dragon fruit are presented in Table 1.4. An interaction effect of chemicals and temperature on chilling injury of dragon fruit was found significant at 8 to 40 days of storage. At 8th days maximum chilling injury was recorded in treatment combination Chitosan 4% i.e. 15.552 % and was found significantly higher than all other treatments. At 40th day of

storage minimum chilling injury observed in treatment Chitosan 2% i.e. 33.350%.

Zhang *et al.*, (2022) [10]. proposed that chitosan treatment reduced chilling injury in cold-stored melons by controlling the metabolism of sugar and starch. When combined, chitosan coating may be a viable preservation technique that reduces chilling damage and increases postharvest shelf life.

Table 5: Interaction effect of chemicals and temperature on the Decay percent of dragon fruit.

Chemicals	0 Days	8 Days	16 Days	24 Days	32 Days	40 Days
1000ppb 1- MCP	2.222	13.887	33.332	3.703	11.107	66.665
1500ppb 1- MCP	2.222	13.888	33.333	11.110	0.047	0.043
Chitosan 2%	0.064	0.076	0.081	0.049	0.040	0.035
Chitosan 4%	0.065	0.074	0.083	0.051	0.044	0.038
SE (m)±	0.000	0.000	0.001	0.000	0.000	0.000
CD at 5%	0.001	0.001	0.002	0.001	0.001	0.001
Temperature						
S1(5°C)	0.065	0.073	0.081	0.075	0.066	0.056
S2(7°C)	0.066	0.066	0.081	0.075	0.065	0.055
S3(control)	0.063	0.075	0.083	0.000	0.000	0.000
SE (m)±	0.000	0.000	0.000	0.000	0.000	0.000
CD at 5%	0.001	0.001	0.001	0.001	0.001	0.001

The data representing the interaction effects of different chemicals and temperature on Decay percent of dragon fruit are presented in Table 1.5. An interaction effect of chemicals and temperature on minimum Decay percent of dragon fruit was found significant at 0 to 40 days of storage. At 8th day minimum Decay percent was recorded in Chitosan 2% treatment i.e. 0.074 % and was found significantly higher than all other treatments. At 40th day

minimum decay percent was found in Chitosan 2% treatment) i.e. 0.035 % whereas maximum decay percent was found in 1000ppb 1- MCP i.e. 66.665. Chutichudet *et al.*, (2015) ^[2]. found variations in the natural antifungal chemicals in ripening fruit may be the cause of the similar trend in rotting appearance reduction following 1-MCP treatment.

Table 6: Interaction effect of chemicals and temperature on the lightness (L* value) of dragon fruit.

Chemicals	0 Days	8 Days	16 Days	24 Days	32 Days	40 Days
1000ppb 1- MCP	9.022	8.593	4.163	4.497	4.442	4.087
1500ppb 1- MCP	8.643	7.773	4.452	4.113	3.337	3.560
Chitosan 2%	6.448	5.617	3.600	3.647	3.703	3.302
Chitosan 4%	6.743	5.992	4.587	4.343	3.965	4.600
SE (m)±	0.005	0.007	0.006	0.002	0.002	0.002
CD at 5%	0.015	0.019	0.019	0.007	0.007	0.007
Temperature						
S1(5°C)	8.383	7.638	5.963	5.677	5.309	6.933
S2(7°C)	7.594	6.924	5.509	5.726	5.700	5.840
S3(control)	5.614	4.859	0.000	0.000	0.000	0.000
SE (m)±	0.003	0.004	0.004	0.001	0.001	0.001
CD at 5%	0.009	0.012	0.012	0.004	0.004	0.004

The interaction effect of chemicals and temperature on the lightness of dragon fruit was found to be significant at all the stages of storage 0, 8, 16, 24, 32 and 40 days which is presented in table 1.6. At 0 days of storage, the maximum L* value i.e. 9.022 was recorded in 1000ppb 1- MCP treatment on the other hand, the minimum L* value was noted in Chitosan 2% treatment i.e. 6.448. At 40th day of storage, among all the interactions the maximum L* value i.e. 4.600 was recorded in Chitosan 4%

and the minimum L* value i.e. 3.302 was noted in Chitosan 2% treatment. Yamaga *et al.*, suggested that in both the presence and absence of ethylene treatment, 1-MCP treatment prolonged/maintained fruit firmness and peel color, suggesting that its action may be through ethylene suppression or metabolic system activation.

Conclusion

According to the results of the current study, it was noted that various chemical treatment and storage temperature were having significant impact on the physiological, biochemical, and quality properties of dragon fruit during storage. Within all of the treatments, the maximum physiological loss in weight (PLW) was recorded in 1500ppb 1- MCP, whereas, the minimum PLW was

recorded in Chitosan 2% (C3S2), suggesting that Chitosan 2% does a better job in terms of moisture retention. Regarding the respiration rate, the maximum value in the storage period was recorded in 1500ppb 1- MCP whereas, the minimum in Chitosan 2% indicated low metabolic rate with such treatment. The maximum ethylene evolution was recorded in 1500ppb 1- MCP, especially at the late days of storage which incidentally recorded the minimum ethylene production suggesting delayed ripening in Chitosan 2%. The maximum value of decay percentage was observed in 1500ppb 1- MCP, which indicates that it can be stored better than 1000ppb 1- MCP. There are the minimum and the maximum L* values (chromatic attribute reflecting lightness) were found in Chitosan 2% and 1000ppb 1- MCP, respectively.

References

1. Ariffin AA, Bakar J, Tan CP, Rahman RA, Karim R, Loi CC. Essential fatty acids of pitaya (dragon fruit) seed oil. Food Chem. 2009;114:561–564.
2. Chutichudet B, Chutichudet P, Usana T. Effects of 1-MCP on external postharvest qualities and shelf life of 'Maha Chanok' mango fruit. J Agric Sci. 2015.
3. Jeronimo MC, Orsine JVC, Novaes MRCG.

- Nutritional, pharmacological and toxicological characteristics of pitaya (*Hylocereus undatus*): A review of the literature. *Afr J Pharm Pharmacol*. 2017;11:300–304.
4. Jiang Y, Zhang Z, Joyce DC, Ketsa S. Postharvest biology and handling of longan fruit (*Dimocarpus longan* Lour.). *Postharvest Biol Technol*. 2002;26(3):241–252.
 5. Jitareerat P, Paumchai S, Kanlayanarat S, Sangchote S. Effect of chitosan on ripening, enzymatic activity, and disease development in mango (*Mangifera indica*) fruit. *N Z J Crop Hortic Sci*. 2007.
 6. Khuituan P, K-da S, Bannob K, Hayeeawaema F, Peerakietkhajorn S, Tipbunjong C, *et al*. Prebiotic oligosaccharides from dragon fruits alter gut motility in mice. *Biomed Pharmacother*. 2019;114:108821.
 7. Shin Y, Liu RH, Nock JF, Holliday D, Watkins CB. Temperature and relative humidity effects on quality, total ascorbic acid, phenolics and flavonoid concentrations, and antioxidant activity of strawberry. *Postharvest Biol Technol*. 2007;45:349–357.
 8. Utpott M, Araujo RR, Vargas CG, Paiva ARN, Tischer B, Rios ADO, *et al*. Characterization and application of red pitaya (*Hylocereus polyrhizus*) peel powder as a fat replacer in ice cream. *J Food Process Preserv*. 2020;44:e14420.
 9. Wichienchot S, Jatupornpipat M, Rastall RA. Oligosaccharides of pitaya (dragon fruit) flesh and their prebiotic properties. *Food Chem*. 2010;120:850–857.
 10. Zhang Q, Tang F, Cai W, Peng B, Ning M, Shan C, *et al*. Chitosan treatment reduces softening and chilling injury in cold-stored Hami melon by regulating starch and sucrose metabolism. *Front Plant Sci*. 2022.
 11. Zulkifli SA, Gani SSA, Zaidan UH, Halmi MIE. Optimization of total phenolic and flavonoid contents of defatted pitaya (*Hylocereus polyrhizus*) seed extract. 2020.