Available online at www.scholarsresearchlibrary.com

Scholars Research Library

Scholars Research Library

Annals of Biological Research, 2018, 10 (1): 10-18

(http://www.scholarsresearchlibrary.com)

ISSN 0976-1233
CODEN (USA): ABRNBW

ISSN:0976-1233

Extending the Storage-Life and Post-Storage Life of Capsicum cvs. 'Bachata F1' and 'Inspiration F1' Using Cold Storage

Parag Babaji Jadhav[1*] and Nikhil Pradip Gurav[2]

[1]*Agricultural Research Expert, Survey No. 134/1, 134/2,130/3, Jeevan Nagar, Tathawade, Pune, Maharashtra, India*

[2]*Agricultural Research Associate, Ecofrost Technologies Pvt. Ltd., Survey No. 134/1, 134/2,130/3, Jeevan Nagar, Tathawade, Pune, Maharashtra-411033, India*

***Corresponding Author:** Dr. Parag Babaji Jadhav, Agricultural Research Expert Survey No. 134/1, 134/2,130/3, Jeevan Nagar, Tathawade, Pune, Maharashtra, India, E-mail: parag@ecozensolutions.com*

ABSTRACT

Uniform and healthy capsicum fruits of cv. 'Bachata F1' (yellow colored) and 'Inspiration F1' (red colored) were used to study the storage-life (days) inside a cold room of Ecofrost and normal room conditions. The capsicum fruits of cv. 'Bachata F1' (yellow) and 'Inspiration F1' (red) were harvested in the morning session at the right stage near 90% colored stage. The aim of the study was to determine the effectiveness of cold storage on the post-harvest storage-life (days) of capsicum cv. 'Bachata F1' and 'Inspiration F1' at 10°C and 93% relative humidity. The results showed that keeping the fruits of capsicum cv. 'Bachata F1' (15 Days) and 'Inspiration F1' (15 days) inside cold storage, recorded better retention of fruit qualities. The chilling symptoms weren't observed inside cold storage conditions. Average post-storage Shelf-life (days) was observed in cv. 'Inspiration F1' and cv. 'Bachata F1' to be 3.00 days and 3.68 days, respectively at room temperature after taking out of the cold room. The average weight loss was recorded in red cv. Inspiration F1 [2.72% day-1 (27.23 kg 1000 kg-1 day-1)] and in yellow cv. Bachata F1 [2.47% day-1 (24.73 kg 1000 kg-1 day-1)] at normal room temperature and ambient humidity. Average skin shriveling was observed at normal room conditions in cvs. 'Bachata F1' and 'Inspiration F1'as on days 4.5 and 3.81 after taking out of the cold room, respectively. Shelf-life was recorded on days under normal room temperature for capsicum red and yellow cultivars as 3.5 and 4.5 days, respectively.

Keywords: Capsicum, Inspiration, Bachata, Ecofrost, Cold, Shelf-life, etc.

INTRODUCTION

Sweet Pepper consumption in India is increasing nowadays due to increasing demand by urban consumers. There is a good demand for export too. The export market needs fruits with longer shelf life, medium size, tetra lobed fruits with an attractive dark color, mild pungency and good taste [1]. But, the supply is inadequate due to the low productivity of the crop. There is increased demand for capsicum by the consumers and lot of farmers are also showing interest in the cultivation of this crop under protected conditions, as this type is having definite qualitative and quantitative advantage over the traditional cultivation. Capsicum is used for various problems with digestion including intestinal gas, stomach pain, diarrhea, and cramps. It is also used for conditions of the heart and blood vessels including poor circulation, excessive blood clotting, high cholesterol [2], and preventing heart disease. Other use includes relief of a toothache, seasickness, alcoholism, malaria, and fever. It should be waxy, firm, and free of wrinkles. An overripe capsicum is withered, shrunken and has the appearance of aged leather. While wrinkled bell peppers are edible, they will not be as sweet or robust as their firm-skinned counterparts. The sweet pepper fruit is a rich source of vitamins, especially vitamin A, C and E. It also contains thiamine, vitamin B6, beta-carotene, and folic acid.

Capsicums are grown under shade net houses and greenhouses to get good quality and better yield around the year. It also imparts peculiar beauty, taste, and flavor to cooking the vegetables and other dishes [1].

MATERIALS AND METHODS

The experiment was carried out in the Agricultural Laboratory of Ecofrost Technologies Pvt. Ltd. Tathawade, Pune (MH), India, from 5th to 25th May 2017. Capsicum cvs. 'Bachata F1' and 'Inspiration F1' were harvested near 90% color attained stage. Fruits of each cultivar were selected for their uniform size, shape, color, and quality. Fruits of each cultivar were harvested in the morning hours of 5th May 2017. Shelf-life (days) was recorded by the number of days held in normal room conditions of capsicum cvs. 'Bachata F1' and 'Inspiration F1' between the time of harvest and the end of edibility. Also, Post-harvest life at ambient conditions was recorded in both cultivars of capsicum um. Capsicum fruits of both cultivars were subjected to cold storage treatment at 10°C and 93% relative humidity and control treatment to room temperature.

At Ecofrost Technologies Pvt. Ltd., Agricultural Research Laboratory, fruits of both cultivars were kept at room temperature [3] and kept inside cold storage conditions (10°C and 93% RH [3]. The data was collected and taken for further investigation. Every day the same two fruit of each variety were used for weight loss checking inside cold storage. On 0, 3rd, 5th, 7th, 9th, 11th, 13th, and 15th days; two fruit of each variety were taken out of cold storage and kept at room temperature to measure the weight loss, post-storage life and shriveling [4].

RESULTS

Chilling (č) injury symptoms weren't recorded during the experimentation period. Similarly, radical cracking was not seen in both varieties of capsicum inside a cold room of Ecofrost.

Average post-storage shelf-life (days) was observed in cvs. 'Inspiration F1' and cv. 'Bachata F1' as 3.00 days and 3.68 days, respectively under room temperature after taking out the fruits of cold storage (Table 1) (Figures 1-8). The average weight loss was recorded in red (Table 2a) cv. 'Inspiration F1' [2.72% day-1 (27.23 kg 1000 kg-1 day-1)] and in yellow (Table 2b) cv. 'Bachata F1' [2.47% day-1 (24.73 kg 1000 kg-1 day-1)] at room conditions with no humidity control. Average weight loss was recorded in percentage inside cold storage for capsicum red (Table 3a) cv. 'Inspiration F1' [0.80% day-1 (8 kg 1000 kg-1 day-1)] and yellow (Table 3b) cv. 'Bachata F1' [0.58% day-1 (5.8 kg 1000 kg-1 day-1) (Figure 9). Average skin shriveling was observed at room temperature for capsicum red and yellow cultivars as on days 3.81 and 4.5; respectively after taking out of cold storage. Average skin shriveling was delayed in cv. 'Bachata F1' than cv. 'Inspiration F1' (Table 4). Shelf-life was recorded at room temperature for capsicum red and yellow cultivars as 3.5 and 4.5 days, respectively (Table 1). The average storage-life of capsicum fruits cv. 'Inspiration F1' and 'Bachata F1' record up to 15 days under low temperature (10°C) and high relative humidity (93%) conditions (Figure 9). The average post-storage life was recorded maximum in 'Bachata F1' than 'Inspiration F1' (Table 1). Under dissections of capsicum cvs. 'Inspiration F1' and 'Bachata F1' some symptoms were observed which is shown in Figure 10. The temperature was the major factor in determining the post-harvest performance of sweet pepper. This increases the relative humidity that reduces vapor pressure deficit and transpiration. This could be attributed to the slowdown of physiological processes such as respiration and transpiration that occur at low temperatures [5]. Wide fluctuations in temperature at RT increased the rates of water loss from sweet pepper possibly by increasing vapor pressure deficit between the tissue and the surrounding air leading to enhancement of transpiration [6]. In addition, high temperatures increased the rate of respiration and other metabolic processes that caused depletion of substrates like sugars and proteins resulting in further weight loss [7]. As water evaporates from the tissue, turgor pressure decreases, and the cells begin to shrink, netting and collapse thus leading to loss of freshness. Higher loss in green color at ambient temperatures with no humidity control may be caused by an increased breakdown of chlorophyll and synthesis of β-carotene and lycopene pigments, which occur during ripening [8]. Lowering the temperature of fruits like sweet pepper lowers their rate of ripening and deterioration. Symptoms of soft rot start as water-soaked lesions which rapidly spread and develop into the deterioration of the fruit into a slimy, foul-smelling mass. The bacteria responsible for soft rot produce cellulolytic and pectolytic enzymes that rapidly break down cells walls [4]. The low temperature induces a change in the physical properties of cell membrane due to changes in the physical state of membrane lipids. The chilling injury causes the release of metabolites such as amino

acids, sugars and mineral salts from cells that together with the degradation of the cell structure provide an excellent substrate for the growth of pathogenic organisms, especially fungi [9].

Table 1: Post-Storage shelf-life of capsicum cvs. 'Inspiration F1' and 'Bachata F1' at normal room conditions after taken out from cold storage on different days.

Fruit took out from cold storage on days and held at normal room conditions	**Red cv. 'Inspiration F1'**	**Yellow cv. 'Bachata F1'**
	Post-storage shelf-life (Days)	
0 Days	3.5	4.5
After 2 Days	3	4
After 4 Days	3	4
After 6 Days	3	3.5
After 8 Days	3	3.5
After 10 Days	3	3.5
After 12 Days	3	3.5
After 14 Days	2.5	3

Table 2a: Weight loss of red fruit of cv. 'Inspiration F1' taken out of cold storage to normal room conditions.

At room conditions (Fruit took out of cold storage on days)	**Red cv. Inspiration F1**		**Weight in percentage**	**Weight loss in Percentage**	**Kg weight loss per 1000 kg**
	Initial Weight (g) (Cold storage)	**Final weight (g) after 4 days storage**	**Final weight after 4 days storage**	**After 4 days storage**	**After 4 days storage**
		At normal room conditions			
On zero day	435.36	381.81	87.7	12.3	123
On 3rd day	410.22	358.38	87.36	12.64	126.4
On 5th day	470.5	417.44	88.72	11.28	112.8
On 7th day	413.81	365.21	88.26	11.74	117.4
On 9th day	385.88	364.44	89.78	10.22	102.2
On 11th day	449.97	406.32	90.3	9.7	97
On 13th day	371.41	335.68	90.38	9.62	96.2
On 15th day	310.73	280.8	90.37	9.63	96.3

Table 2b: Weight loss of yellow fruit cv. 'Bachata F1' taken out of cold storage to normal room conditions.

At room conditions (Fruit took out of cold storage on days)	**Yellow cv. Bachata F1**		**Weight in%**	**Weight loss in %**	**Kg weight loss per 1000 kg**
	Initial Weight (g) (Cold storage)	**Final weight (g) after 4 days storage**	**Final weight after 4 days storage**	**After 4 days storage**	**After 4 days storage**
		At normal room conditions			
On zero day	502.5	444.71	88.5	11.5	115
On 3rd day	554.68	489.32	88.22	11.78	117.8
On 5th day	503.33	457.9	90.97	9.03	90.3
On 7th day	431.57	387.15	89.71	10.29	102.9

On 9th day	415.04	379.95	91.55	8.45	84.5
On 11th day	419.41	384.84	91.76	8.24	82.4
On 13th day	508.35	460.15	90.52	9.48	94.8
On 15th day	339.04	304	89.66	10.34	103.5

Table 3a: Weight loss percentage inside cold storage for capsicum red cv. 'Inspiration F1'.

Inside Cold storage conditions	**Red cv. Inspiration F1**		**Weight in percentage**			**Kg weight loss 1000kg-1 day-1**
	Initial Weight (g)	**Final weight (g) after every day**	**Initial Weight**	**Final weight after 1-day storage**	**Percent weight loss after 1-day storage**	
Initial weight	448.56	445.02	100	99.21	0.79	7.9
On 2nd day	445.02	441.12	100	98.34	1.66	16.6
On 3rd day	441.12	438.41	100	97.74	2.26	22.6
On 4th day	438.41	434.83	100	96.94	3.06	30.6
On 5th day	434.83	431.38	100	96.17	3.83	38.3
On 6th day	431.38	427.46	100	95.3	4.7	47
On 7th day	427.46	424.09	100	94.54	5.46	54.6
On 8th day	424.09	420.24	100	93.69	6.31	63.1
On 9th day	420.24	416.52	100	92.86	7.14	71.4
On 10th day	416.52	412.77	100	92.02	7.98	79.8
On 11th day	412.77	408.99	100	91.16	8.84	88.4
On 12th day	408.99	404.66	100	90.21	9.79	97.9
On 13th day	404.66	400.7	100	89.33	10.67	106.7
On 14th day	400.7	396.8	100	88.46	11.54	115.4
On 15th day	396.8	393.3	100	87.68	12.32	123.2

Table 3b: Weight loss percentage inside cold storage for capsicum yellow cv. 'Bachata F1'.

Inside Cold storage conditions	**Yellow cv. Bachata F1**		**Weight in percentage**			**Kg weight loss 1000kg-1 day-1**
	Initial Weight (g)	**Final weight (g) after every day**	**Initial Weight**	**Final weight after 1-day storage**	**Percent weight loss after 1-day storage**	
Initial weight	460.72	458.19	100	99.45	0.55	5.5
On 2nd day	458.19	455.96	100	98.97	1.03	10.3
On 3rd day	455.96	454.05	100	98.55	1.45	14.5
On 4th day	454.05	452.25	100	98.16	1.84	18.4
On 5th day	452.25	448.83	100	97.42	2.58	25.8
On 6th day	448.83	445.69	100	96.74	3.26	32.6
On 7th day	445.69	443.27	100	96.21	3.79	37.9
On 8th day	443.27	440.16	100	95.54	4.46	44.6

On 9th day	440.16	437.22	100	94.9	5.1	51
On 10th day	437.22	434.06	100	94.21	5.79	57.9
On 11th day	434.06	431.28	100	93.61	6.39	63.9
On 12th day	431.28	428.41	100	92.99	7.01	70.1
On 13th day	428.41	425.61	100	92.38	7.62	76.2
On 14th day	425.61	423.2	100	91.86	8.14	81.4
On 15th day	423.2	420.8	100	91.34	8.66	86.6

Table 4: Skin shriveling observed at normal room conditions after taken out of cold storage in capsicum cvs. 'Inspiration F1' and 'Bachata F1'.

Fruit took out from cold storage on days and held at normal room conditions	**Red cv. Inspiration F1**	**Yellow cv. Bachata F1**
	Skin shriveling observed on days	
0 Days	4	5
After 2 Days	4	5
After 4 Days	4	5
After 6 Days	4	4.5
After 8 Days	4	4.5
After 10 Days	4	4.5
After 12 Days	3.5	4
After 14 Days	3	3.5

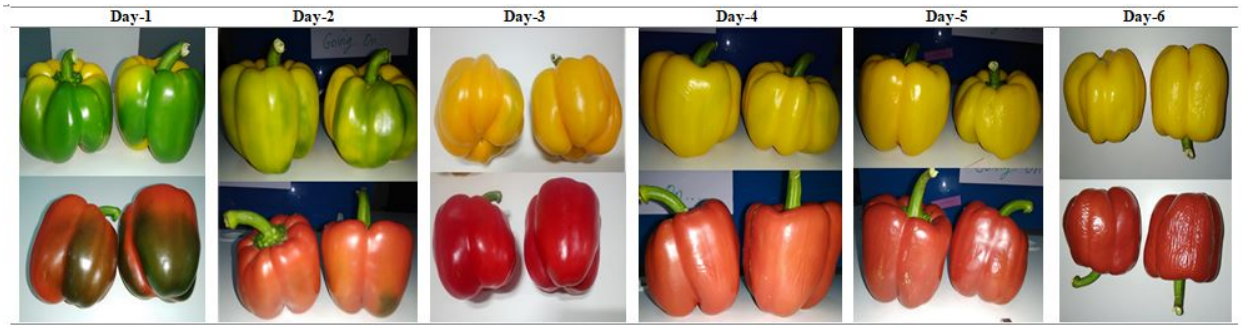

Figure 1: Photos taken on different days without cold storage of capsicum fruit cvs. 'Inspiration F1' (Red) and 'Bachata F1' (Yellow).

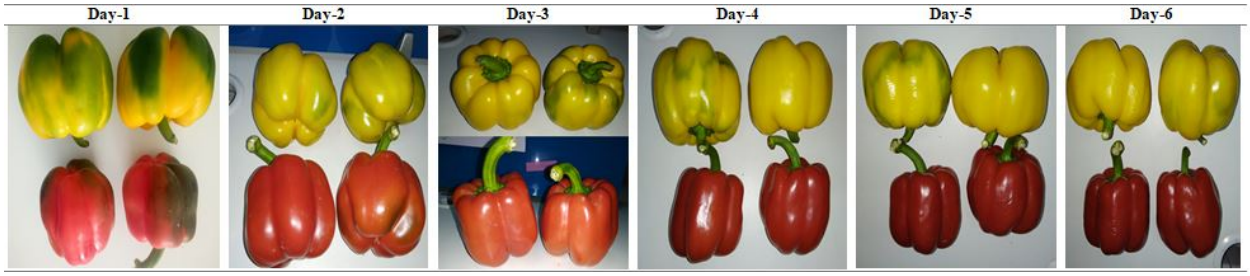

Figure 2: Capsicum fruits of cvs. 'Inspiration F1' (Red) and 'Bachata F1' (Yellow) taken out after 2 days from cold storage of Ecofrost and held at normal room temperature without relative humidity control.

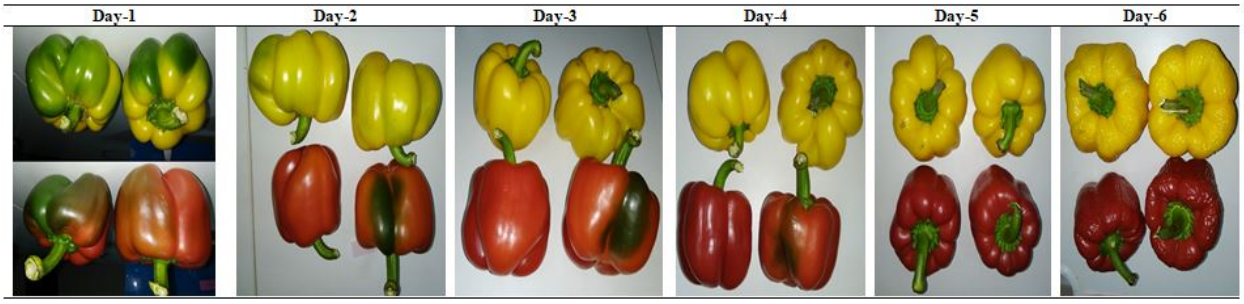

Figure 3: Capsicum fruits of CVS. 'Inspiration F1' (Red) and 'Bachata F1' (Yellow) taken out after 4 days from cold storage of Ecofrost and held at normal room temperature without relative humidity control.

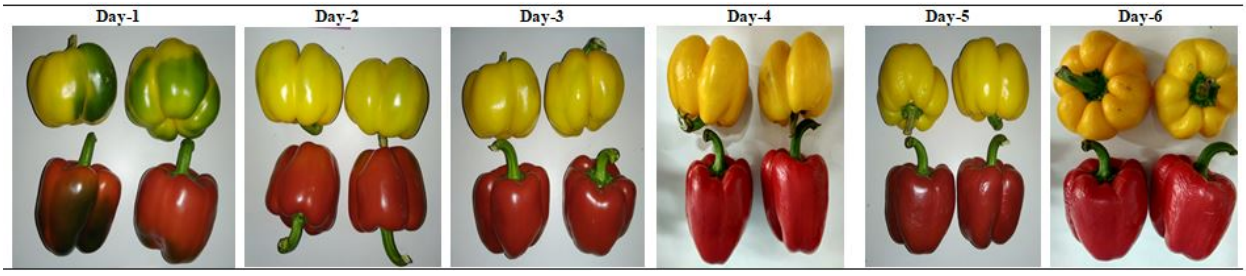

Figure 4: Capsicum fruits of cvs. 'Inspiration F1' (Red) and 'Bachata F1' (Yellow) taken out after 6 days from cold storage of Ecofrost and held at normal room temperature without relative humidity control.

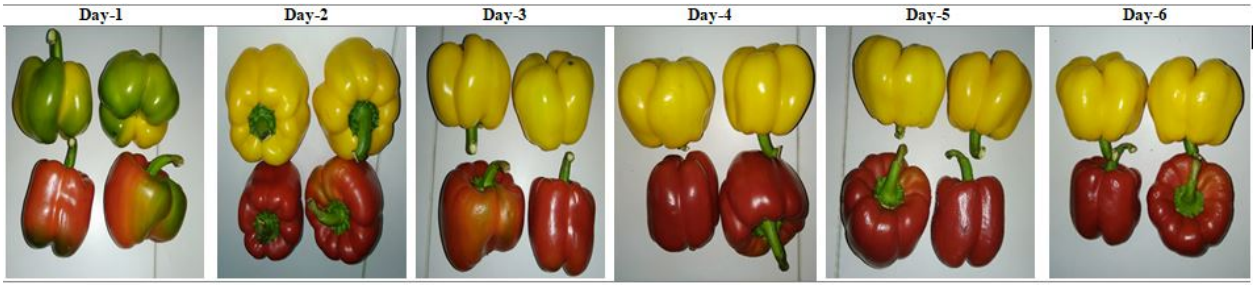

Figure 5: Capsicum fruits of cvs. 'Inspiration F1' (Red) and 'Bachata F1' (Yellow) taken out after 8 days from cold storage of Ecofrost and held at normal room temperature.

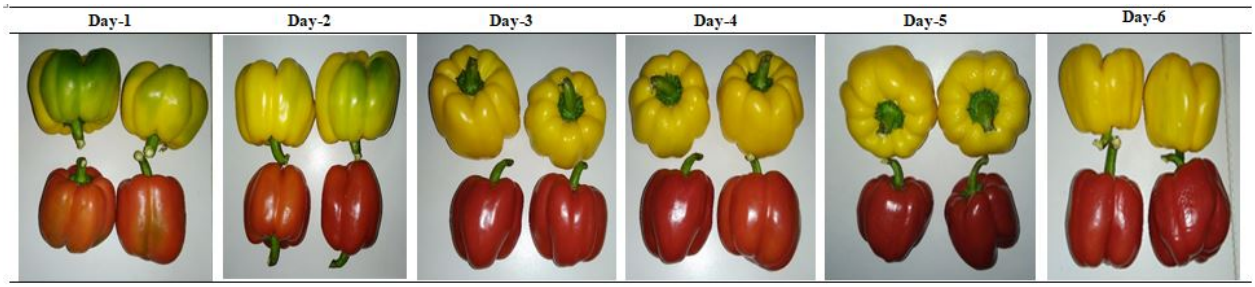

Figure 6: Capsicum fruits of cvs. 'Inspiration F1' (Red) and 'Bachata F1' (Yellow) taken out after 10 days from cold storage of Ecofrost and held at normal room temperature.

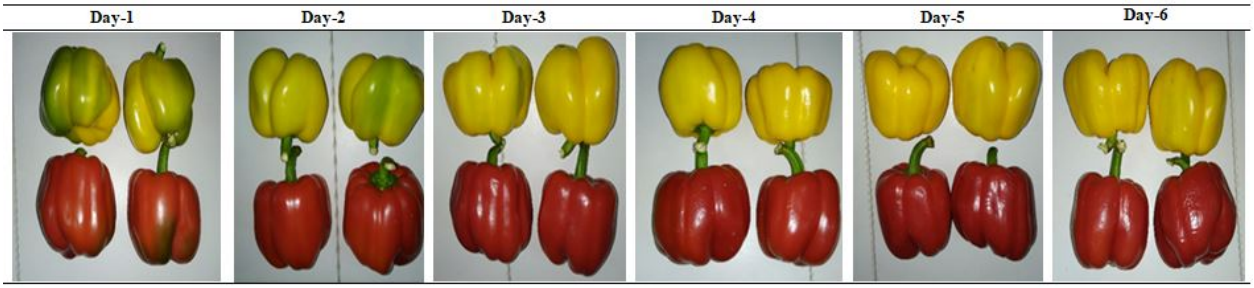

Figure 7: Capsicum fruits of cvs. 'Inspiration F1' (Red) and 'Bachata F1' (Yellow) taken out after 12 days from cold storage of Ecofrost and held at normal room temperature.

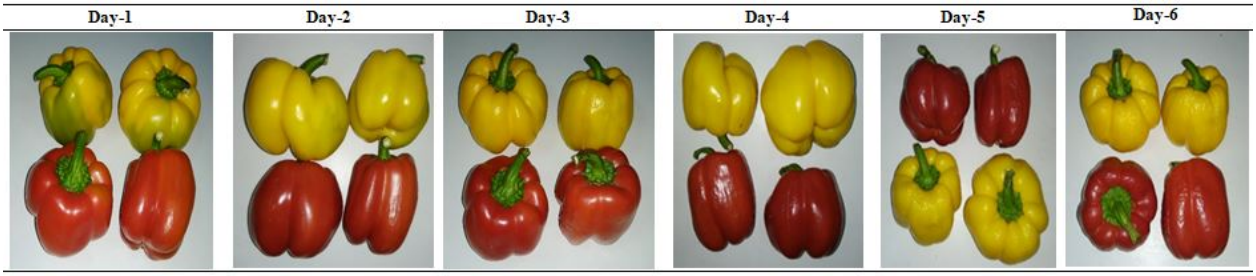

Figure 8: Capsicum fruits of cvs. 'Inspiration F1' (Red) and 'Bachata F1' (Yellow) taken out after 14 days from cold storage of Ecofrost and held at normal room temperature.

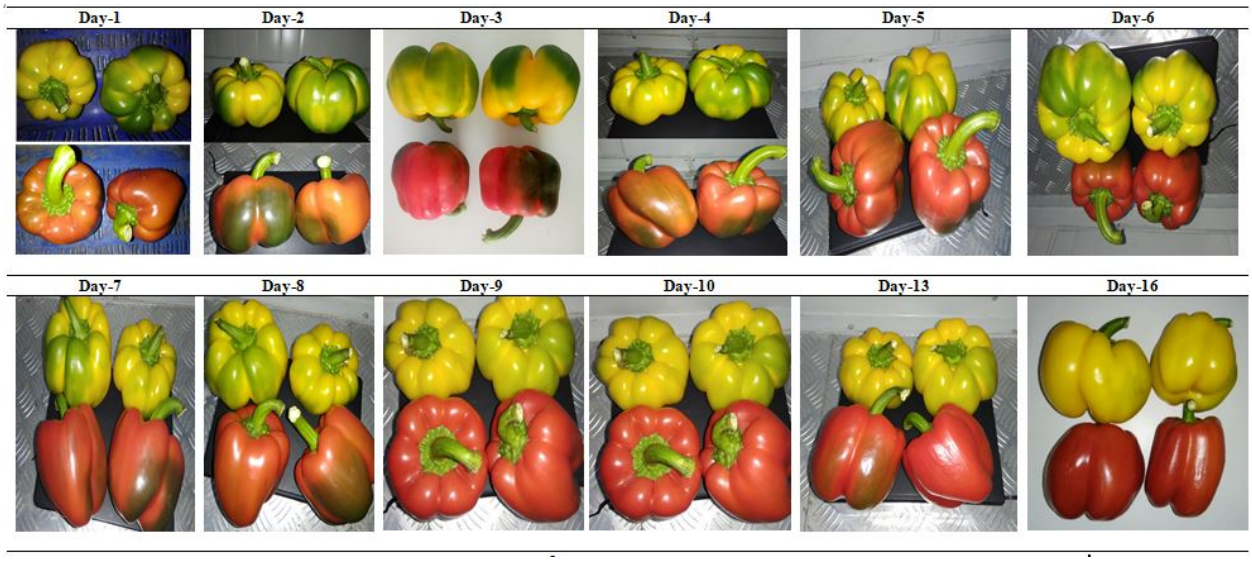

Figure 9: Photos were taken on different days from cold storage of Ecofrost (10°C and 93% RH) of capsicum fruits cvs. 'Inspiration F1' and 'Bachata F1'.

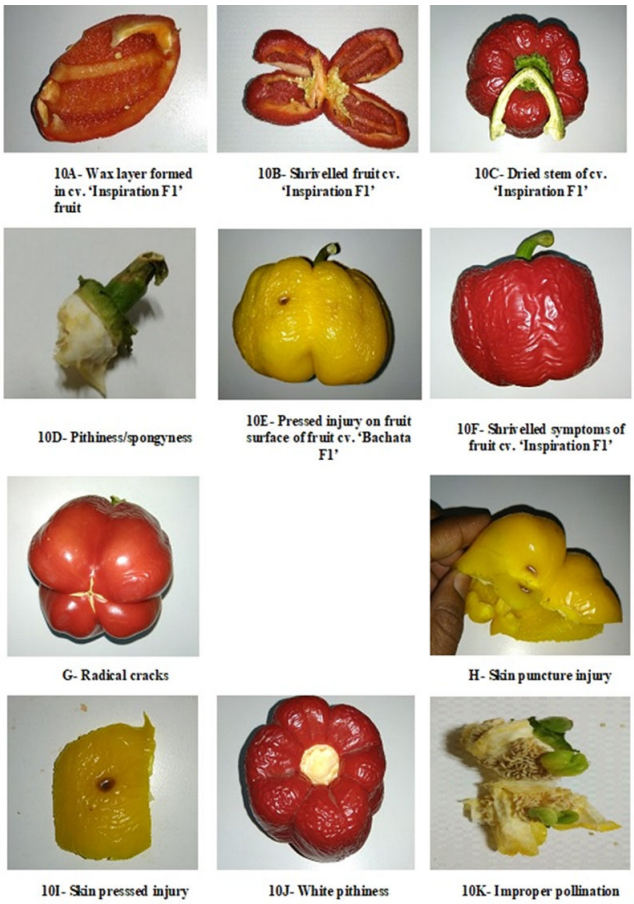

Figure 10: Under dissections of capsicum cvs. 'Inspiration F1' and 'Bachata F1', the above points were observed.

CONCLUSION

The storage-life of capsicum fruits cvs. 'Inspiration F1' and 'Bachata F1' can be extended up to 15 days under low temperature (10°C) and high relative humidity (93%) conditions. Average weight loss (1000 kg-1 day-1) was recorded under cold storage for capsicum cv. 'Inspiration F1' [8 kg 1000 kg-1 day-1] and cv. 'Bachata F1' [5.5 kg 1000 kg-1 day-1]. Post-storage shelf-life was recorded for capsicum fruit cv. 'Bachata F1' as higher than 'Inspiration F1' in normal room conditions, after fruit which was taken out from a cold storage. Capsicum fruit of cv. 'Bachata F1' and 'Inspiration F1' which were kept at room conditions retained shelf-life as 4.5 and 3.5 days, respectively.

Acknowledgment

The authors are grateful to the Directors of Ecofrost Technologies Pvt. Ltd., Survey no 134/1, 134/2,130/3, Jeevan Nagar, Tathawade, Pune, Maharashtra-411 033 for providing excellent facilities for conducting the research work.

REFERENCES

[1] Tarara, J. M., Microclimate modification with plastic mulch. *Hort Scienc*, **2000**. 35(1): p. 169-180

[2] Murray, M.N.D, et al., The encyclopaedia of healing foods. *Atria Books*, **2005**. New York.

[3] Jadhav, P.B., et al., Extend the storage life through cold conditions in capsicum cvs. 'Bachata f1', 'Mashelia', 'Bombay green' and 'Local green'. *Int J Agri Sci*, **2018**. 10(17): p. 7092-7101.

[4] Jadhav, P.B., et al., Extending the storage and post-storage shelf-life of strawberry fruit cv. "sweet charlie" using cold storage. *Int J Res Rev*, **2018**. 9(3): p. 532-542.

[5] Kays, S.J., Post-harvest physiology and handling of perishable plant products, *Van Nostrand Reinhold*, New York. **1991**. p. 526.

[6] Ben-Yehoshua, S., Transpiration, water, and gas exchange. *Postharvest Postharvest Physio veg*, **1987**. p. 113-170.

[7] Buescher, R.W, The influence of high temperature on physiological and compositional characteristics of tomato fruits. *Lebensm Wiss Technol*, **1979**. 12(1): p. 162-164.

[8] Grieson, D., et al., Fruit ripening and quality. in: the tomato crop: a scientific basis for improvement. *Chapman and Hall*, New York, **1986**. p. 241-275.

[9] Wills, R., et al., Postharvest: an introduction to the physiology and handling of fruit, vegetables, and ornamentals. *CAB Int*, **1998**. 1: p. 262.