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BR Surani

Department of Horticulture,
B.A. College of Agriculture,
Anand Agricultural University,
Anand, Gujarat, India

AP Patel

Department of Horticulture,
B.A. College of Agriculture,
Anand Agricultural University,
Anand, Gujarat, India

Lokesh Yadav

Department of Horticulture,
B.A. College of Agriculture,
Anand Agricultural University,
Anand, Gujarat, India

Correspondence**BR Surani**

Department of Horticulture,
B.A. College of Agriculture,
Anand Agricultural University,
Anand, Gujarat, India

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Effect of post-harvest application of chemicals on bio-chemicals parameters of different Ber (*Ziziphus mauritiana* Lamk.) varieties during storage

BR Surani, AP Patel and Lokesh Yadav

Abstract

An investigation entitled effect of post-harvest application of chemicals on the shelf life of ber (*Ziziphus mauritiana* Lamk.) fruits was conducted during the *Rabi* 2015-16 at P. G. Laboratory, Department of Horticulture, BACA, AAU, Gujarat. It was laid out in CRD with Factorial concept having sixteen treatment combinations, comprising of two variety of ber *viz.*, Gola and Umran and different chemical concentration of ascorbic acid (100 and 150 mg/l), cycocel (500, 750 and 1000 mg/l) and KMnO₄ (0.05 and 0.1%) along with control. The treatments were repeated thrice. Periodic observations at initial, 3rd, 6th and 9th day of storage periods were taken. The results obtained from present investigation indicated that Gola ber was recorded the significantly highest total soluble sugar (°Brix) at 6th and 9th day, ascorbic acid (mg/100 g pulp) at initial, 3rd, 6th and 9th day, total sugar (%) at initial and 6th day, reducing sugar (%) at initial, 3rd, 6th and 9th day and non-reducing sugar (%) at 6th day. However, Umran ber was recorded the significantly highest total soluble sugar (°Brix) at initial and 3rd day, total sugar (%) at 9th day and non-reducing sugar (%) at 9th day whereas, significantly minimum acidity (%) at initial, 3rd, 6th and 9th day under ambient condition during storage. Among the different post-harvest application of chemicals cycocel @ 1000 mg/l treatment recorded significantly highest in bio-chemical parameters like total soluble sugar (°Brix) and reducing sugar (%) at initial, 3rd, 6th and 9th day, total sugar (%) and non-reducing sugar (%) at 3rd, 6th and 9th day and significantly minimum acidity (%) at initial, 3rd, 6th and 9th day. However, ascorbic acid @ 150 mg/l recorded significantly highest ascorbic acid (mg/100 g pulp) contain at initial, 3rd, 6th and 9th day and KMnO₄ @ 0.1% recorded significantly highest total sugar (%), reducing sugar (%) and non-reducing sugar (%) at initial day of storage period.

Keywords: Bio-chemicals parameters, ber

Introduction

Ber (*Ziziphus mauritiana* Lamk.) is one of the most ancient fruit of India and it ranked third in fruit production. Ber is an important fruit crop of arid and semi-arid regions. It belongs to genus *Zizyphus* of family *Rhamanaceae*. It is found growing wild, semi-wild in cultivated from in almost all parts of India. The genus *Zizyphus* includes about 50 species, out of which 18 to 20 are native of India (Watt, 1893) [9]. Ber is mainly grown in the states of Andhra Pradesh, Bihar, Gujarat, Haryana, Madhya Pradesh, Maharashtra, Punjab, Rajasthan and Uttar Pradesh While, in Gujarat it is cultivated in districts of Ahmedabad, Bharuch, Bhavnagar, Gandhinagar, Junagadh, Banaskantha, Kutch, Kheda, Anand, Mehsana and Sabarkantha. Ber is considered as a "poor man's apple", it is nutritive and delicious.

The predominant cultivars that are being grown in Gujarat are Umran, Kadaka, Sanaur-3, Sanaur-6 and Popular Gola. Out of various cultivars Umran is commercially cultivated in Gujarat. Fruits are larger in size, oval to elliptical in shape with roundish apex and average weight between 35-40 g. The fruits have an attractive golden yellow colour which turns into a chocolate brown colour at full maturity. Its fruit mature in the mid-season (February to March) and ripen during mid-March to mid-April when other fruits are not available. However, Gola variety is early variety and very popular. The fruit is ovate to round in shape and the size of fruits is medium. It develops greenish to golden yellow colour at ripening stage. The quality of fruits is excellent but cannot stand long transport. The average weight of fruit varies from 15-20 g (Chattopadhyay, 2009).

The increase in the shelf life of ber fruit would, therefore, be of advantage to the growers. Post-harvest application of ascorbic acid, cycocel and use of KMnO_4 has been reported to improve the shelf life of ber fruit (Siddiqui and Gupta, 1995) [8].

Materials and Methods

The experiment was carried out at P. G. Laboratory, Department of Horticulture, B. A. College of Agriculture, Anand Agricultural University, Anand, during *Rabi* 2015-16. The experiment was laid out in Completely Randomized Design with Factorial concept having sixteen treatment combinations, comprising of two variety of ber fruit *viz.*, Gola and Umran and dipped in different chemical concentration for 15 minutes of ascorbic acid (100 and 150 mg/l), cycocel (500, 750 and 1000 mg/l) and KMnO_4 (0.05 and 0.1%) along with control. The treatments were repeated thrice. The observations like total soluble solids ($^{\circ}\text{Brix}$), acidity (%), ascorbic acid (mg/100g pulp), total sugar (%), reducing sugar (%) and non-reducing sugar (%) were recorded during storage period. Observations recorded at every three (3) days interval up to the ripening during storage period.

Results and Discussion

The findings of present study as well as relevant discussion have been presented under following heads:

Effect of Varieties

The data presented that, among the varieties, Gola ber was recorded the significantly highest total soluble sugar ($^{\circ}\text{Brix}$) at 6th and 9th day (14.09, 12.66 $^{\circ}\text{Brix}$, respectively), ascorbic acid at initial, 3rd, 6th and 9th day (67.67, 59.69, 52.15 and 18.43 mg/100 g pulp, respectively), total sugar at initial and 6th day (4.85 and 8.99%, respectively), reducing sugar at initial, 3rd, 6th and 9th day (2.13, 4.70, 5.06 and 3.90%, respectively) and non-reducing sugar at 6th day (3.93%). However, Umran ber

was recorded the significantly highest total soluble sugar at initial and 3rd day (11.16 and 12.73 $^{\circ}\text{Brix}$, respectively), total sugar at 9th day (6.72%) and non-reducing sugar at 9th day (3.00) whereas, significantly minimum acidity at initial, 3rd, 6th and 9th day (0.276, 0.250, 0.203 and 0.176%, respectively) under ambient condition during storage. This might be due to conversion of reserved starch and polysaccharides to soluble form of sugar. Similar results were also reported by Lal *et al.* (2004) [5], Shukla *et al.* (2007) [7], Pandey and Singh (2012) [6] in ber.

Effect of Chemicals

Among the different post-harvest application of chemicals cycocel @ 1000 mg/l treatment recorded significantly highest in bio chemical parameters like total soluble sugar (10.71, 13.80, 14.99 and 13.21 $^{\circ}\text{Brix}$) and reducing sugar (2.07, 5.37, 5.88 and 4.11%) at initial, 3rd, 6th and 9th day respectively, total sugar (9.78, 10.36 and 7.65%) and non-reducing sugar (4.40, 4.54 and 3.53%) at 3rd, 6th and 9th day respectively and significantly minimum acidity (0.293, 0.245, 0.190 and 0.163%) at initial, 3rd, 6th and 9th day respectively. However, ascorbic acid @ 150 mg/l recorded significantly highest ascorbic acid (70.78, 66.03, 58.93 and 20.28 mg/100 g pulp) contain at initial, 3rd, 6th and 9th day respectively and KMnO_4 @ 0.1% recorded significantly highest total sugar (4.93%), reducing sugar (2.07%) and non-reducing sugar (2.85%) at initial day of storage period. This might be due to the application of cycocel stimulates the functioning of number of enzymes in the physiological processes. It seems possible that cycocel hastened ripening of fruits and accelerated the activities of hydrolytic enzymes resulting into higher sugar content. The similar result was reported by Kahlon and Dhillon (2011) [3] in grape, Kumar *et al.* (2012) [4] in strawberry and Gill *et al.* (2014) [2] in guava.

Table 1: Effect of post-harvest application of chemicals on bio-chemicals parameters of different ber varieties during storage

Treatments	Total Soluble Solids ($^{\circ}\text{Brix}$)				Acidity (%)				Ascorbic acid (mg/100 g pulp)			
	0 day	3 day	6 day	9 day	0 day	3 day	6 day	9 day	0 day	3 day	6 day	9 day
V ₁ - Gola	8.34	12.21	14.09	12.66	0.424	0.323	0.235	0.195	67.67	59.69	52.15	18.43
V ₂ - Umran	11.16	12.73	13.63	11.91	0.276	0.250	0.203	0.176	64.01	56.83	47.51	17.50
S.Em. \pm	0.102	0.12	0.13	0.13	0.005	0.004	0.003	0.001	0.31	0.72	0.57	0.11
C.D. at 5%	0.293	0.36	0.38	0.38	0.010	0.013	0.010	0.002	0.91	2.07	1.64	0.32
Chemicals (C)												
C ₁ - Ascorbic acid (100 mg/l)	9.45	12.32	13.42	11.98	0.350	0.285	0.233	0.200	69.43	62.92	56.45	19.63
C ₂ - Ascorbic acid (150 mg/l)	9.71	12.49	13.56	11.99	0.351	0.286	0.225	0.193	70.78	66.03	58.93	20.28
C ₃ - Cycocel (500 mg/l)	9.56	12.46	13.68	11.79	0.336	0.288	0.218	0.190	65.35	56.56	48.93	17.71
C ₄ - Cycocel (750 mg/l)	10.08	12.45	14.43	12.77	0.335	0.275	0.220	0.180	66.71	59.07	51.43	18.36
C ₅ - Cycocel (1000 mg/l)	10.71	13.80	14.99	13.21	0.293	0.245	0.190	0.163	61.84	55.52	42.53	16.15
C ₆ - KMnO_4 (0.05%)	10.33	12.57	14.35	12.55	0.363	0.283	0.208	0.180	68.07	59.52	53.91	19.00
C ₇ - KMnO_4 (0.1%)	9.36	12.03	13.72	12.60	0.373	0.266	0.206	0.171	64.00	55.62	46.43	17.08
C ₈ - Control	8.79	11.62	12.70	11.43	0.399	0.365	0.253	0.210	60.53	50.80	40.01	15.50
S.Em. \pm	0.204	0.25	0.26	0.26	0.010	0.009	0.007	0.001	0.63	1.43	1.14	0.22
C.D. at 5%	0.586	0.73	0.76	0.76	0.028	0.025	0.019	0.003	1.82	4.14	3.29	0.65
Interaction V\timesC												
C. V%	5.11	4.98	4.71	5.31	6.826	7.468	7.472	1.437	2.35	6.04	5.62	3.09

Table 2: Effect of post-harvest application of chemicals on bio-chemicals parameters of different ber varieties during storage

Treatments	Total sugar (%)				Reducing sugar (%)				Non reducing sugar (%)			
	0 day	3 day	6 day	9 day	0 day	3 day	6 day	9 day	0 day	3 day	6 day	9 day
V ₁ - Gola	4.85	8.48	8.99	6.38	2.13	4.70	5.06	3.90	2.72	3.79	3.93	2.47
V ₂ - Umran	4.62	8.38	8.37	6.72	1.97	4.62	4.92	3.71	2.65	3.78	3.46	3.00
S.Em. \pm	0.02	0.08	0.09	0.08	0.02	0.08	0.05	0.04	0.02	0.05	0.05	0.02
C.D. at 5%	0.06	NS	0.28	0.24	0.07	NS	NS	0.11	NS	NS	0.15	0.07
Chemicals (C)												
C ₁ - Ascorbic acid (100 mg/l)	4.58	8.01	7.86	6.27	2.03	4.51	4.71	3.73	2.58	3.51	3.15	2.54

C ₂ - Ascorbic acid (150 mg/l)	4.66	8.43	8.01	6.40	2.04	4.85	4.73	3.82	2.65	3.57	3.28	2.57
C ₃ - Cycocel (500 mg/l)	4.72	8.26	8.60	6.50	2.05	4.53	4.89	3.91	2.65	3.73	3.71	2.59
C ₄ - Cycocel (750 mg/l)	4.77	8.27	9.11	6.61	2.06	4.46	5.18	3.95	2.73	3.80	3.92	2.65
C ₅ - Cycocel (1000 mg/l)	4.88	9.78	10.36	7.65	2.07	5.37	5.88	4.11	2.80	4.40	4.54	3.53
C ₆ - KMnO ₄ (0.05%)	4.82	8.55	9.32	6.31	2.06	4.70	4.93	3.71	2.75	3.91	4.39	2.60
C ₇ - KMnO ₄ (0.1%)	4.93	8.44	8.34	6.81	2.07	4.41	4.90	3.86	2.85	4.02	3.44	2.94
C ₈ - Control	4.53	7.75	7.84	5.86	2.02	4.45	4.72	3.38	2.50	3.30	3.11	2.47
S.Em. ±	0.04	0.17	0.19	0.17	0.05	0.16	0.11	0.08	0.05	0.11	0.10	0.05
C.D. at 5%	0.13	0.51	0.56	0.24	NS	0.48	0.33	0.23	0.14	0.32	0.30	0.14
Interaction V×C	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	Sig.	Sig.
C. V%	2.40	5.13	5.53	6.36	6.12	8.77	5.61	5.13	4.58	7.26	6.89	4.50

Conclusion

On the basis of laboratory study it can be concluded that Gola variety had higher quality parameters. Whereas post-harvest application of cycocel @ 1000 mg/l (dipping for 15 minutes) improved quality parameters (total soluble solid, total sugar, reducing sugar and non- reducing sugar). Application of ascorbic acid @ 150 mg/l effective for increasing ascorbic acid content of ber fruits under ambient storage condition.

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