Int.J.Curr.Microbiol.App.Sci (2018) *7*(11): 1085-1093

International Journal of Current Microbiology and Applied Sciences
***ISSN: 2319-7706* Volume 7 Number 11 (2018)**
Journal homepage: http://www.ijcmas.com

Original Research Article https://doi.org/10.20546/ijcmas.2018.711.126

Effect of Grading and Post-Harvest Application of Chemicals on Bio-Chemical Parameters of Custard Apple (*Annona squamosa* L.) cv. Balanagar

C. Chaudhary Mahadevbhai and Ankur P. Patel*

Department of Horticulture, B. A. College of Agriculture, Anand Agricultural University, Anand 388110, Gujarat, India

**Corresponding author*

Keywords

Grading, Chemicals, Biochemical parameters

Article Info

Accepted:
10 October 2018
Available Online:
10 November 2018

A B S T R A C T

The present study was carried out under ambient storage condition which is located at P. G. Laboratory, Department of Horticulture, B. A. College of Agriculture, Anand Agricultural University, Anand, Gujarat, India during the year *rabi* 2017 to investigate the "Effect of grading and post-harvest application of chemicals on quality and shelf life of custard apple (*Annona squamosa* L.) cv. Balanagar". The experiment was laid out in Completely Randomized Design with Factorial concept having ten treatment combinations. An experiment comprised with two factors (1) Grade – A, Grade – B and (2) two chemical levels of Ascorbic acid (500 and 1000 mg/l), and $KMnO_4$ (0.05 and 0.1%) of custard apple fruit viz., Balanagar along with control. The treatments were repeated thrice. Among all the treatments, treatment G_1 (Grade – A) was most effective treatment and which was recorded significantly minimum acidity, maximum ascorbic acid, total sugar, reducing sugar and non-reducing sugar whereas treatment C_4 ($KMnO_4$ @ 0.1%) recorded significantly maximum Total soluble solid, Total sugar, Reducing sugar and Non- reducing sugar and Application of ascorbic acid @ 1000 mg/l effective for increasing ascorbic acid while minimum acidity was recorded in control in custard apple fruits under ambient storage condition.

Introduction

Custard apple (*Annona squamosa* L.) belongs to family Annonaceae is one of the finest fruit gifted to India by tropical America. It is a common cultivated crop in India, China, Philippines and Cuba. Now it is widely distributed in the tropics and warmer sub-tropics. The fruit grows on a small deciduous tree and is known by different names worldwide. The fruit is around 8 centimeters in diameter and has a sweet and delicious taste. The shape of the fruit may be lopsided, irregular, spherical, heart shaped, or round. It has a creamy and granular textured flesh, surrounded by seeds.

The skin of the fruit is thin and tough, mostly black and green in colour. This crop is known as various names like sitaphal, sugar apple, sweet soup and sarifa. Custard apple popular in the Deccan plateau is one of the most

important fruit due to its nutritional and medicinal values. The fruits contain sugars, minerals and vitamins which are known to serve as blood tonic (Rao, 1974). The edible portion or pulp is a creamy and granular with a good blend of sweetness. It contains protein (1.6 g), fat (0.5-0.6 g), carbohydrate (23.5 g), crude fiber (0.9-6.6 g), calcium (17.6 g), phosphorus (47 mg), iron (1.5 g), thiamine (0.075-0.119 mg), riboflavin (0.086-0.175 mg), ascorbic acid (15.0-44.4 mg) and nicotinic acid (0.5 mg) per 100g of edible portion. An ancorin is extracted from custard apple seed/pulp, which has insecticidal properties and therefore used as botanical insecticide. Due to the presence of annonaine, the leaves, stem and other portions of the plant are also bitter and the plant is not attacked by goats or cattle (Katyal *et al.,* 1963). The decrease in ascorbic acid during storage is due to conversion of ascorbic acid to dehydoascorbic acid due to the action of ascorbic acid oxidase. The gradual declined of ascorbic acid in treated fruits might be due to its increased biosynthesis, or decreased oxidation during storage. A reduction in ascorbic acid content with the subsequent prolongation of storage might be due to rapid oxidation phenomenon of organic acid in later stage of storage (Orzolek and Argel, 1974).

Preventing build-up of ethylene around produce is among the methods in use to delay ripening of custard apple. Potassium permanganate used for extending the shelf life of fruits, vegetables and ornamentals. $KMnO_4$ is an ethylene absorbent that reduce ethylene action in storage. Its desirable effect in delaying ripening and senescence, increase in firmness, vitamin C and phenolic contents, reduce respiration, extending storage life and reducing the incidence of physiological disorder and storage rots. $KMnO_4$ treatment is fruits protects against post-harvest deterioration by binding with hydrolysis such as galacto-uronase and promotes shelf life.

Materials and Methods

The experiment was conducted on "effect of grading and post-harvest application of chemicals on physiological parameters of custard apple (*Annona squamosa* L.) cv. Balanagar" was carried out at P. G. Laboratory, Department of Horticulture, B. A. College of Agriculture, Anand Agricultural University, Anand, Gujarat, India during the year *rabi* 2017. The experiment was laid out in Completely Randomized Design with Factorial concept having ten treatment combinations. An experiment comprised with two factors (1) Grade – A, Grade – B and (2) two chemical levels of Ascorbic acid (500 and 1000 mg/l), and KMnO4 (0.05 and 0.1%) of custard apple fruit viz., Balanagar along with control. The treatments were repeated thrice. The mature and uniform sized fruits were harvested from the respective trees and kept in ambient storage condition where observations were recorded regarding the physiologicalparameters of the fruits.

Results and Discussion

The results obtained from the present investigation was conducted oneffect of grading and post-harvest application of chemicals on biochemical parameters of custard apple fruit under ambient storage condition are presented in Table 1 to 6.

Effect of grading and post-harvest application of chemicals on total soluble solids of custard apple fruit

The effect of grades was found non-significant effect on total soluble solids. In case of chemical application, was recorded significantly the maximum total soluble solids (TSS) was significantly higher in control at 1st, 2nd and 3rd day of storage period (23.11, 24.60 and 25.26 ^{0}Brix, respectively), at 4th day it was maximum TSS (26.17 ^{0}Brix, respectively) in

Ascorbic acid @ 500 mg/l (C_1) and at 5th day it was maximum TSS (26.75 ^{0}Brix) in $KMnO_4$ @ 0.1% (C_4). The significantly minimum TSS 1st, 2nd and 3rd day of storage period (18.19, 20.61 and 22.52 ^{0}Brix, respectively) was observed with $KMnO_4$ @ 0.1% (C_4). While at 4th and 5th day minimum TSS (24.12 and 23.26 ^{0}Brix, respectively) was observed in control. Which was at par with C_1 treatment during 1st and 3rd day while, C_2 treatment is 2nd and 4th day of storage period. The increase in TSS up to 8 days might be due to conversion of reserved starch and other polysaccharides to soluble form of sugar with the advancement of storage period. The changes brought about in total soluble solids of fruits during ripening are mainly due to degradation of starch and accumulation of sugar. The similar result on total soluble solid were reported by Jawadagi *et al.,* (2013) in custard apple, Fageria *et al.,* (2007) in mango and Lal *et al.,* (2007) in mango. The interaction between different grades and different chemical concentrations with respect to was total soluble solids found to be non-significant.

Effect of grading and post-harvest application of chemicals on acidity of custard apple fruit

The effect of grades was found significant effect on acidity of different grades are on acidity (%) of custard apple fruit was observed significant minimum acidity (20.57, 22.67, 23.74, 24.89 and 24.33% respectively) was recorded in grade-B at1st, 2nd, 3rd, 4th and 5th day of storage period respectively. The significant maximum acidity was recorded in grade-A. In case of chemical application, among all the treatment, $KMnO_4$ @ 0.1% treatment was recorded the acidity was significantly differ by different chemical concentrations. Minimum acidity (0.57, 0.48, 0.28, 0.21 and 0.16%) was found when custard apple fruits were kept in control (C_5) at 1st, 2nd, 3rd, 4th, and 5th day of storage period. While, maximum acidity recorded in $KMnO_4$ @ 0.1% at 1st, 2nd, 3rd, 4th, and 5thday of storage period (0.79, 0.55, 0.46, 0.30 and 0.24%, respectively),which was at par with treatment $KMnO_4$ @ 0.05% (C_3) at 2nd and 5th day and treatment Ascorbic acid @1000 mg/l(C_2) at 5th day of storage period.

The minimum acidity might be due to increase in TSS and metabolic changes with fast conversion of organic acids into sugars and their derivatives by the reactions involving reversal of glycolytic pathway or be used in respiration or both in $KMnO_4$ treatment. The similar result on acidity were reported by Jawadagi *et al.,* (2013) in custard apple, Fageria *et al.,* (2007) in mango and Lal *et al.,* (2007) in mango. The interaction between different grades and different chemical concentrations with respect to physiological loss was found to be non-significant.

Effect of grading and post-harvest application of chemicals on ascorbic acid of custard apple fruit

The effect of grades was found significant effect on ascorbic acidity of different the effect of custard apple fruit was observed significantly the maximum ascorbic acid (30.21, 37.19, 41.61, 37.77 and 33.89 mg/100g pulp, respectively) were recorded in grade-A at 1st, 2nd, 3rd, 4th, and 5th day of storage period, respectively. The significantly minimum ascorbic acid (28.83, 36.44, 40.26, 37.03 and 32.81 mg/100g pulp, respectively) was recorded in grade-B at 1st, 2nd, 3rd, 4th, and 5th day of storage period, respectively. The effect of different grade on ascorbic acid (mg/100g pulp) of custard apple fruit was observed significantly the maximum ascorbic acid (30.21, 37.19, 41.61, 37.77 and 33.89 mg/100g pulp, respectively) were recorded in grade-A at 1st, 2nd, 3rd, 4th, and 5th day of storage period, respectively.

Table.1 Effect of grading and post-harvest application of chemicals on total soluble solids of custard apple fruit

Treatments	Total soluble solids (^{0}Brix)				
	1 day	2 day	3 day	4 day	5 day
Grade (G)					
G_1 : Grade – A	21.39	23.31	24.09	25.11	24.53
G_2 : Grade – B	20.57	22.67	23.74	24.89	24.33
S.Em. ±	0.34	0.25	0.17	0.23	0.31
C.D. at 5%	NS	NS	NS	NS	NS
Chemical (C)					
C_1 : Ascorbic acid @ 500 mg/l	21.95	24.29	24.53	26.17	23.67
C_2 : Ascorbic acid @ 1000 mg/l	21.09	23.47	24.16	25.25	23.91
C_3 : $KMnO_4$ @0.05 %	20.57	21.99	23.09	24.91	24.31
C_4 : $KMnO_4$@0.1 %	18.19	20.61	22.52	24.56	26.75
C_5 : Control (Not treated)	23.11	24.60	25.26	24.12	23.26
S.Em. ±	0.55	0.39	0.27	0.36	0.50
C.D. at 5%	1.61	1.15	0.81	1.05	1.46
Interaction G×C	NS	NS	NS	NS	NS
C.V.%	6.36	4.18	2.80	3.50	4.98

Table.2 Effect of grading and post-harvest application of chemicals on acidity of Custard apple fruit

Treatments	Acidity (%)				
	1 day	**2 day**	**3 day**	**4 day**	**5 day**
Grade (G)					
G_1 : Grade – A	0.66	0.50	0.37	0.24	0.21
G_2 : Grade – B	0.69	0.52	0.39	0.25	0.21
S.Em. ±	0.01	0.01	0.01	0.01	0.01
C.D. at 5%	NS	NS	NS	NS	NS
Chemical (C)					
C_1 : Ascorbic acid @ 500 mg/l	0.64	0.49	0.35	0.22	0.20
C_2 : Ascorbic acid @ 1000 mg/l	0.68	0.50	0.38	0.24	0.22
C_3 : $KMnO_4$ @0.05 %	0.72	0.52	0.41	0.27	0.23
C_4 : $KMnO_4$@0.1 %	0.79	0.55	0.46	0.30	0.24
C_5 : Control (Not treated)	0.57	0.48	0.28	0.21	0.16
S.Em. ±	0.02	0.01	0.01	0.01	0.01
C.D. at 5%	0.05	0.03	0.03	0.02	0.02
Interaction G×C	NS	NS	NS	NS	NS
C.V.%	6.36	5.59	6.07	6.49	6.89

Table.3 Effect of grading and post-harvest application of chemicals on ascorbic acid of custard apple fruit

Treatments	Ascorbic acid (mg/100g pulp)				
	1 day	2 day	3 day	4 day	5 day
Grade (G)					
G_1 : Grade – A	30.21	37.19	41.61	37.77	33.89
G_2 : Grade – B	28.83	36.44	40.26	37.03	32.81
S.Em. ±	0.47	0.70	0.40	0.38	0.34
C.D. at 5%	NS	NS	1.17	NS	0.99
Chemical (C)					
C_1 : Ascorbic acid @ 500 mg/l	31.92	38.43	42.93	40.06	35.12
C_2 : Ascorbic acid @ 1000 mg/l	34.78	41.75	45.89	43.47	36.95
C_3 : $KMnO_4$ @0.05 %	26.77	34.68	38.61	34.21	32.20
C_4 : $KMnO_4$@0.1 %	29.32	35.88	40.91	36.88	32.95
C_5 : Control (Not treated)	24.80	33.32	36.35	32.38	29.55
S.Em. ±	0.75	1.11	0.63	0.59	0.53
C.D. at 5%	2.21	3.26	1.85	1.75	1.57
Interaction G×C	NS	NS	NS	NS	NS
C.V.%	6.20	7.36	3.75	3.88	3.91

Table.4 Effect of grading and post-harvest application of chemicals on total sugar of custard apple fruit

Treatments	Total sugar (%)				
	1 day	2 day	3 day	4 day	5 day
Grade (G)					
G_1 : Grade – A	6.99	7.73	11.50	15.33	15.78
G_2 : Grade – B	6.63	7.42	10.98	14.55	14.77
S.Em. ±	0.10	0.10	0.13	0.25	0.19
C.D. at 5%	0.30	0.29	0.40	0.75	0.56
Chemical (C)					
C_1 : Ascorbic acid @ 500 mg/l	7.06	7.97	11.42	17.31	14.61
C_2 : Ascorbic acid @ 1000 mg/l	6.81	7.58	10.99	15.99	14.96
C_3 : $KMnO_4$ @0.05 %	6.70	7.03	10.49	14.66	16.02
C_4 : $KMnO_4$@0.1 %	5.94	6.42	9.46	13.78	18.16
C_5 : Control (Not treated)	7.54	8.88	13.85	12.96	12.61
S.Em. ±	0.16	0.15	0.22	0.40	0.30
C.D. at 5%	0.48	0.45	0.64	1.19	0.88
Interaction G×C	Sig.	NS	NS	NS	NS
C.V.%	5.85	4.95	4.69	6.59	4.77

Table.5 Effect of grading and post-harvest application of chemicals on reducing sugar of custard apple fruit

Treatments	Reducing sugar (%)				
	1 day	2 day	3 day	4 day	5 day
Grade (G)					
G_1 : Grade – A	5.77	5.61	8.97	12.24	12.76
G_2 : Grade – B	5.47	5.46	8.54	11.55	11.88
S.Em. ±	0.10	0.11	0.14	0.25	0.30
C.D. at 5%	0.28	NS	0.41	NS	0.88
Chemical (C)					
C_1 : Ascorbic acid @ 500 mg/l	5.76	5.65	8.82	13.95	11.74
C_2 : Ascorbic acid @ 1000 mg/l	5.66	5.56	8.64	12.76	11.87
C_3 : $KMnO_4$ @0.05 %	5.60	5.18	8.29	11.55	12.73
C_4 : $KMnO_4$@0.1 %	4.92	5.15	7.37	10.88	14.70
C_5 : Control (Not treated)	6.16	6.16	10.64	10.35	10.56
S.Em. ±	0.15	0.17	0.22	0.40	0.30
C.D. at 5%	0.44	0.50	0.65	1.19	0.87
Interaction G×C	Sig	NS	NS	NS	NS
C.V.%	6.56	7.54	6.18	8.28	5.97

Table.6 Effect of grading and post-harvest application of chemicals on non-reducing sugar

Treatments	Non-reducing sugar (%)				
	1 day	2 day	3 day	4 day	5 day
Grade (G)					
G_1 : Grade – A	1.22	2.11	2.54	3.08	3.02
G_2 : Grade – B	1.16	1.96	2.45	3.00	2.87
S.Em. ±	0.02	0.05	0.03	0.04	0.05
C.D. at 5%	NS	0.13	0.08	NS	NS
Chemical (C)					
C_1 : Ascorbic acid @ 500 mg/l	1.30	2.32	2.60	3.36	2.86
C_2 : Ascorbic acid @ 1000 mg/l	1.15	2.01	2.36	3.23	3.09
C_3 : $KMnO_4$ @0.05 %	1.11	1.85	2.21	3.11	3.30
C_4 : $KMnO_4$@0.1 %	1.02	1.27	2.09	2.90	3.47
C_5 : Control (Not treated)	1.38	2.72	3.21	2.60	2.04
S.Em. ±	0.03	0.07	0.04	0.06	0.07
C.D. at 5%	0.10	0.21	0.13	0.17	0.22
Interaction G×C	NS	NS	NS	NS	NS
C.V.%	6.65	8.65	4.22	4.74	6.17

The significantly minimum ascorbic acid (28.83, 36.44, 40.26, 37.03 and 32.81 mg/100g pulp, respectively) was recorded in grade-B at 1st, 2nd, 3rd, 4th, and 5th day of storage period, respectively. In case of chemical application, among all the treatment, ascorbic acid @ 1000 mg/l (C2) treatment was recorded the ascorbic acid was significantly differ by different chemical concentrations. The maximum ascorbic acid at 1st, 2nd, 3rd, 4th, and 5th day of storage period (34.78, 41.75, 45.89, 43.47 and 36.95 mg/100g pulp, respectively) were found when custard apple fruits were treated with ascorbic acid @ 1000 mg/l (C_2). The significantly minimum ascorbic acid (24.80, 33.32, 36.35, 32.38 and 29.55 mg/100g pulp) was observed with C5 (Control) at 1st, 2nd, 3rd, 4th, and 5th day of storage period, respectively. The decrease in ascorbic acid during storage is due to conversion of ascorbic acid to dehydoascorbic acid due to the action of ascorbic acid oxidase. The gradual declined of ascorbic acid in treated fruits might be due to its increased biosynthesis, or decreased oxidation during storage. The similar results on ascorbic acid reported by Singh *et al.,* (2005) in aonla and Gill *et al.,* (2014) in guava. The interaction between different grades and different chemical concentrations with respect to ascorbic acid was found to be non-significant.

Effect of grading and post-harvest application of chemicals on total sugar of custard apple fruit

The effect of grades was found significant effect on total sugar of different grades. The maximum total sugar it was recorded significantly the maximum in grade-A (6.99, 7.73, 11.50, 15.33 and 15.78%) at 1st, 2nd, 3rd, 4th, and 5thday of storage period, respectively, while the significantly minimum total sugar (6.63, 7.42, 10.98, 14.55 and 14.77%) noted in grade-B at 1st, 2nd, 3rd, 4th, and 5thday of storage period, respectively. In case of chemical application, The maximum total sugar (%) was significantly higher in control at1st, 2ndand 3rd day of storage period (7.54, 8.88 and 13.85%, respectively), at 4th day it was maximum total sugar (17.31%) in Ascorbic acid @ 500 mg/l (C_1) and at 5th day it was maximum total sugar (18.16%) in $KMnO_4$ @ 0.1% (C_4). The significantly minimum total sugar 1st, 2ndand 3rd day of storage period(5.94, 6.42 and 9.46%, respectively) was observed with $KMnO_4$ @ 0.1% (C_4), While at 4th and 5th day minimum total sugar (12.96 and 12.61%, respectively) was observed in control. The increased level of total sugar was possibly due to the application of $KMnO_4$ at different intervals on custard apple. This may be due to conversion of complex polysaccharides into sugars. The similar result on total sugar were reported by Dutta *et al.,* (1991) in guava, Kumar *et al.,* (2001) in guava and Lal *et al.,* (2007) in mango. The interaction between different grades and different chemical concentrations with respect to total sugar was found to be significant.

Effect of grading and post-harvest application of chemicals on reducing sugar of custard apple fruit

The effect of grades was found significant effect on reducing sugar. The data recorded in clearly indicated that there were non-significant difference in respect of reducing sugar (%) during 2nd and 4th day while, significant in 1st, 3rd and 5th day of storage period due to custard apple under ambient storage condition however, it was significant in 1st, 3rd and 5th day of storage period and the maximum (5.77, 8.97 and 12.76%, respectively) reducing sugar (%) was recorded in grade-A as compared to grade-B (5.47, 8.54 and 11.88%, respectively). In case of chemical application, The maximum reducing sugar (%) was significantly higher in

control at 1st, 2nd and 3rd day of storage period (6.16, 6.16 and 10.64%, respectively), at 4th day it was maximum reducing sugar (13.95%) in Ascorbic acid @ 500 mg/l (C_1) and at 5th day it was maximum reducing sugar (14.70%) in $KMnO_4$ @ 0.1% (C_4). The significantly minimum reducing sugar 1st, 2nd and 3rd day of storage period (4.92, 5.15 and 7.37%, respectively) was observed with $KMnO_4$ @ 0.1% (C_4), While at 4th and 5th day minimum reducing sugar (10.35 and 10.56%, respectively) was observed in control. The increase in the level of reducing sugar was possibly due to ripening of fruits which is associated with high metabolic changes in the fruits leading to conversion of complex polysaccharide into simple sugars. It seems possible that $KMnO_4$ hastened ripening of fruits and accelerated the activities of hydrolytic enzymes resulting into higher reducing sugar content. Similar results have been reported by Kumar *et al.,* (2001) in guava. The interaction between different grades and different chemical concentrations with respect to reducing sugar was found to be significant.

Effect of grading and post-harvest application of chemicals on non-reducing sugar of custard apple fruit

The effect of grades was found significant effect on non-reducing sugar. The examination of data regarding non-reducing sugar (%) of different varieties are presented revealed that non-significant during 1st, 4th and 5th day storage period while, the significant difference during 2nd and 3th day of storage period while, the maximum non-reducing sugar was noted in grade-A during 2nd and 3th day storage period (2.11 and 2.54%, respectively). The minimum non-reducing sugar was noted in grade-B during 2nd and 3thday storage period (1.96 and 2.45%, respectively). In case of chemical application, the maximum non-reducing sugar (%) was significantly higher in control (C_5) at 1st, 2nd and 3rd day of storage period (1.38, 2.72 and 3.21%, respectively), at 4th day it was maximum non-reducing sugar (3.36%) in Ascorbic acid @ 500 mg/l (C_1) and at 5th day it was maximum non-reducing sugar (3.47%) in $KMnO_4$ @ 0.1% (C_4). It was at par with the (C_1) at 1st day, with (C_2) at 4th day and with (C_3) at 5th day. The significantly minimum non-reducing sugar 1st, 2nd and 3rd day of storage period (1.02, 1.27 and 2.09%, respectively) was observed with $KMnO_4$ @ 0.1% (C_4), While at 4th and 5th day minimum non-reducing sugar (2.60 and 2.04%, respectively) was observed in control. The increase in the level of non-reducing sugar was possibly due to ripening of fruits which is associated with high metabolic changes in the fruits leading to conversion of complex polysaccharide into monosaccharides due to the application of $KMnO_4$. A similar kind of result was reported by Gohlani and Bisen (2012) in custard apple. The interaction between different grades and different chemical concentrations with respect to non-reducing sugar was found to be non-significant. On the basis of laboratory study it can be concluded that grade-A had recorded biochemical parameter viz., had minimum acidity, maximum ascorbic acid, total sugar, reducing sugar and non-reducing sugar. Whereas post-harvest application of KMnO4 @ 0.1% (dipping for 15 minutes) improved biochemical parameters that' Total soluble solid, Total sugar, Reducing sugar and Non-reducing sugar and application of ascorbic acid @ 1000 mg/l effective for increasing ascorbic acid whiles minimum acidity was recorded in control in custard apple fruits under ambient storage condition.

References

Dutta, P., Banik, A. K., Raychaudhury, R., and Dhua, R. S. (1991). Influence of ethylene absorbents on shelf life of

guava fruits. Indian Journal of Horticulture, 48 (3), 213-216.

Fageria, M. S., Lal, G., Dhaka, R. S., and Choudhary, M. R. (2007). Studies on post-harvest management of ber cv. Umran. Indian Journal of Horticulture, 64 (4), 469-471.

Gill, K. B. S., Dhaliwal, H. S., and Mahajan, B. V. C. (2014). Effect of post-harvest treatment of ascorbic acid on shelf life and quality of guava (*Psidium guajava* L.) cv. Allahabad Safeda. International Journal of Agricultural Science and Veterinary Medicine, 2, 130-141.

Gohlani, S., and Bisen, B. P. (2012). Effect of different coating material on the storage behavior of custard apple (*Annona squamosa* L.). The Bioscan, 7 (4), 637-640.

Jawadagi, R. S., Patil, D. R., Peerajade, D. A., Shreedhar D., and Aachari R. (2013) Studies on effect of post-harvest treatments on quality and shelf life of custard apple cv Balanagar. The Asian Journal of Horticulture, 8 (2), 494-497.

Katyal, S. L., Krishnamurti, S., and Singh, S. (1963). Chemical proportion of custard apple tree. Fruit culture in India, pp. 239-246.

Kumar, N., Singh, R., and Kumar, R. (2001). Effect of ethylene absorbents as post-harvest treatments on the shelf-life of guava (*Psidim guajava* L.) cv. L-49 during storage. Haryana. J. Hort. Sci., 30 (3-4), 167-70.

Lal, G., Singh, R. V., and Saran, P. L. (2007). Shelf life and quality of mango cv. Dashehari as influenced by various chemicals under different storage conditions. Haryana Journal of Horticultural Sciences, 36 (3/4), 259-261.

Nath, A., Dubey, A. K., and Yadav, D. S. (2004). A note on the shelf life of peach fruit cv. Ta 170 under ambient condition. Progressive Horticulture, 36, 16-18.

Orzolek, M. D., and Argell, F. F. (1974). Effect of ethephon on ascorbic acid and soluble solids in processing tomato cultivars. Hort. Sci., 9, 306.

Pandey, G., and Singh, B. P. (2007). Comparative response of 1-methylcyclopropene and KMnO4 on post-harvest behaviour of mango. Indian Journal of Horticulture, 64 (2), 123-126.

Pareek, S., Kitinoja, L., Kaushik, R. A., and Paliwal, R. (2009). Postharvest physiology and storage of ber. Stewart Postharvest Review, 5 (5), 1-10.

Rao, S. N. (1974). Annonas-the legendary fruit. Ind. J. Hort. Sci., 19 (3), 19–21.

Singh, S., Singh, A. K., and Joshi, H. K. (2005). Prolong storability of Indian gooseberry (*Emblica officinalis* Gaertn.) under semiarid ecosystem of Gujarat. Indian J. Agric. Science., 75, 647-650.

Sukhjit, K., J, Navjor, G., and Randhawa, J. S. (2012). Effect of post-harvest treatments on enzyme activity and quality of cold stored ber fruit. J. Not. Sci. Biol., 4 (4), 86-89.

How to cite this article:

Chaudhary Mahadevbhai, C. and Ankur P. Patel. 2018. Effect of Grading and Post-Harvest Application of Chemicals on Bio-Chemical Parameters of Custard Apple (*Annona squamosa* L.) cv. Balanagar. *Int.J.Curr.Microbiol.App.Sci.* 7(11): 1085-1093.
doi: https://doi.org/10.20546/ijcmas.2018.711.126