Website : www.asthafoundation.in
Progressive Research : An International Journal
Vol 17 (1) : 53-56 (January-2022), Print ISSN : 0973-6417, Online ISSN : 2454-6003
Society for Scientific Development in Agriculture and Technology, Meerut (U.P.) India

Effect Pre-Harvest Spray of Calcium and Potassium Nutrients Sources on Storage Behaviour of Aonla *(Emblica officinalis* Gaertn.) Fruits Cv. Hathijhool

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Abstract

Results revealed that minimum of physiological weight loss (5.37, 8.60 and 16.60%), minimum percentage of decay loss (9.08 and 17.25%), maximum specific gravity (1.08, 1.07, and 1.05) maximum percentage of marketable fruit (100, 90.92 and 82.75%) on 5th 10th and 15th days of storage period respectively was recorded in T_3 (calcium nitrate @ 2%). Maximum TSS (12.90, 13.03, 13.13 and 13.27 ^{o}Brix) on 0th, 5th, 10th and 15th days of storage period was recorded with the application 1.5% @ potassium sulphate (T_8). The maximum acidity (1.92, 1.90, 1.88 and 1.87%) on 0th, 5th, 10th and 15th day was recorded with the application calcium nitrate @ 1.5% (T_2). Maximum total sugars (5.78, 6.12, 6.33 and 6.53%) and maximum reducing sugar (3.33, 3.47, 3.58 and 3.72%), respectively on 0th, 5th, 10th, and 15th days of storage period was recorded in T_9.

Key words : *Preharvest, spray, calcium, potassium, storage behaviour, aonla.*

Introduction

Aonla *[Emblica officinalis* Gaertn] syn. [*Phyllanthus emblica* Gaertn.] belongs to family *Euphorbiaceae*, and sub-family *Phyllathoidae* is an important fruit crop of commercial significance. It is quite hardy, prolific bearer and remunerative even without much care. Indian gooseberry is an under-utilized fruit tree with medicinal and herbal qualities. Its fruit is tonic for diuretic, laxative, antibiotic and act as cooling refrigerant. It is the richest source of vitamin "C" (500 mg/100 g) among all fruits except Barbados cherry and rich in pectin, iron, calcium and phosphorus. It is also known as *amritphal*. It is indigenous to tropical south-eastern Asia, particularly in central and southern India. Fruit pulp of Indian gooseberry is an important ingredient of *chavanprash* and *triphala* powder which is used for curing different abnormalities. The fruit contains a chemical substance gallic acid and leucoanthocyanin that has antioxidant property.

In India aonla is wildly distributed in Himalaya Region, U.P, Chhota Nagpur, Bihar, Orissa, West Bengal, Deccan and Karnataka. The total cultivated area under aonla in India is 92,000 hectares with annual production of 1063,000 MT (1). Madhya Pradesh forests have rich diversity of aonla. The pathological losses in fruits start soon after the harvesting which requires systematic study on shelf-life and storage stability of aonla fruits. Pre-harvest calcium application have been used to delay aging or ripening to reduce post-harvest decay and to control the development of physiological disorders in different fruits. Firming and resistance to softening resulting from addition of calcium have been attributed to the stabilization of membrane systems and formation of Ca-pectate, which increase rigidity of the middle portion & cell wall of the fruit. Chemicals like calcium compounds have been reported to prolong shelf- life by affecting the wide range of physiological processes in plants and also inhibit specific aspects of abnormal senescence in aonla fruit (2).

Among various nutrients, potassium is considered to be of high importance and is known to have profound influence on fruit quality through its influence on size, appearance, color, soluble solids, acidity and vitamin contents. It has also beneficial role in recovery of nutritional and physiological disorder in fruit trees.

Materials and Methods

The present investigation was carried out at Instructional cum research fruit orchard and laboratory of department of fruit science during the year 2017. Ten year old aonla trees were treated at three concentrations (1.0, 1.5 and 2.0%) of calcium and potassium nutrients sources from calcium nitrate, calcium chloride and potassium sulphate. The experiment was laid out in randomized block design (RBD) with three replications consisted ten treatments. Single spray of calcium nitrate, calcium chloride, and potassium sulphate was done on 26 December 2017 and fruits harvested after 20 days and stored for 15 days.

Rotting was expressed on percentage basis

$$\text{Per cent rotting} = \frac{\text{Rotten fruits}}{\text{Total fruits}} \quad 100$$

Total soluble solid in fruits was recorded at room temperature using hand refractometer (Erma,Tokyo, Japan) and expressed in term of °Brix.

Acidity in fruit was estimated as method described by (3).

Received : October-2021; Revised : October-2021; Accepted : October-2021

Table-1 : Pre-harvest spray of calcium nitrate, calcium chloride and potassium sulphate on physiological loss in weight (%), Decay loss (%), Specific gravity and Marketable fruits (%) of aonla (*Emblica officinalis* Gaertn) fruits cv. Hathijhool.

Treat-ments	Physiological loss in weight (%)				Decay loss (%)				Specific gravity				Marketable fruits (%)			
	0 day	5 days	10 days	15 days	0 day	5 days	10 days	15 days	0 day	5 days	10 days	15 days	0 day	5 days	10 days	15 days
T_0	0.00	10.08	17.15	23.73	0.00	0.00	14.60	26.29	0.98	0.95	0.92	0.90	100	100	85.40	73.71
T_1	0.00	6.59	9.72	17.04	0.00	0.00	10.20	18.21	1.02	1.01	0.98	0.96	100	100	89.80	81.79
T_2	0.00	5.39	8.65	16.64	0.00	0.00	9.10	17.30	1.07	1.05	1.04	1.02	100	100	90.90	82.70
T_3	0.00	5.37	8.60	16.60	0.00	0.00	9.08	17.25	1.08	1.08	1.07	1.05	100	100	90.92	82.75
T_4	0.00	6.92	10.06	17.28	0.00	0.00	10.33	18.30	1.01	0.98	0.97	0.94	100	100	89.67	81.70
T_5	0.00	5.96	8.72	16.70	0.00	0.00	9.30	17.55	1.03	1.02	1.00	0.99	100	100	90.70	82.45
T_6	0.00	5.92	8.68	16.68	0.00	0.00	9.25	17.48	1.06	1.04	1.02	1.01	100	100	90.75	82.52
T_7	0.00	7.60	12.20	19.43	0.00	0.00	12.10	21.55	1.00	0.97	0.95	0.93	100	100	87.90	78.45
T_8	0.00	7.30	12.00	19.16	0.00	0.00	11.90	21.30	1.01	0.99	0.98	0.97	100	100	88.10	78.70
T_9	0.00	7.28	11.96	19.08	0.00	0.00	11.90	21.22	1.03	1.00	0.99	0.98	100	100	88.10	78.78
S.Em.±	0.00	0.09	0.08	0.10	0.00	0.00	0.05	0.04	0.010	0.012	0.008	0.019	0.00	0.00	0.03	0.03
CD at 5%	0.00	0.28	0.24	0.30	0.00	0.00	0.17	0.14	0.029	0.036	0.024	0.058	0.00	0.00	0.10	0.11

Reducing sugars in fruit juice was estimated by the method as suggested by (4).

Results and Discussion

Physiological loss in weight : Physiological loss in weight during storage is characterized by reduction in fruit weight by the way of loss of moisture through evaporation and/or transpiration. It is the most important parameter because it governs the post-harvest quality of the aonla fruits. In general physiological losses in weight decreased with the advancement of storage period, which can be observed from Table-1.

In the present investigation, the minimum of physiological weight loss (5.37, 8.60 and 16.60%) was recorded on 5th, 10th and 15th days of storage period, respectively with the application of calcium nitrate @ 2% (T_3) followed by T_2 (5.39, 8.65 and 16.64%) on 5th, 10th and 15th days of storage period, respectively. The possible reason for reduced weight loss by chemicals may be due to some chemical changes within the fruits; resulting in retention of more water against the rate of evaporation. The present observation are supported by (5, 6, 7, 8, 9).

Decay loss (%) : The minimum percentage of decay loss (9.08 and 17.25%) on 10th and 15th day of storage period respectively was recorded in T_3 (calcium nitrate @ 2%) which was followed by T_2 (9.10 and 17.30%). This might be due to higher firmness of fruit which might have delayed the pathogen and other microorganism infection for longer period, among the various treatments.

Rotting of the fruit is another important fruit quality parameter and occurrence of rotting adversely affects the shelf-life of fruits. Rotting caused due to infection by fungus, mainly *blue mould (Penicillium citrinum)* makes the fruit soft and affected fruits develop bad odour**.** The calcium nitrate, potassium sulphate, lead to resistance in the fruits against the pathogens, which resulted in least decay loss. In the present investigation, application of calcium nitrate alone allowed minimum rotting during storage. The role of calcium nitrate reducing decay loss has been reported by (2, 6, 10, 11, 12, 13) in guava.

Specific gravity : It is clear from Table-1 that specific gravity of the fruit decreased continuously with increase in storage period. However, the treated fruits recorded higher values of specific gravity. This could be attributed to reduced loss of weight and decrease of volume and also due to conversion of starch into sugar. Reduction in fruit weight and volume as well as increased transpiration and respiration, might have resulted into declining trend in specific gravity of fruit. The treatments reduce the weight loss and respiration losses, thus were helpful in maintaining higher values of specific gravity. Maximum specific gravity (1.08, 1.07, and 1.05) on 5th 10th and 15th day storage period respectively was recorded with the application of Calcium nitrate @ 2% (T_3). Similar findings were also reported by (2, 9) in aonla (13, 14) in guava.

Marketable fruits (%) : In general marketable fruits percentage reduced with the advancement of storage period. In the present investigation, the maximum percentage of marketable fruit (100, 90.92 and 82.75%) on 5th 10th and 15th days of storage period respectively was recorded in T_3 (calcium nitrate @ 2%) which was followed by T_2 (100, 90.90 and 82.70%) on 5th 10th and 15th days, respectively.

The higher percentage of marketable fruits was obtained only when there had been reduction loss in weight, spoilage and quality of the fruits with respect to chemical constituents. The significant impact of calcium nitrate, calcium chloride and potassium sulphate on

Table-2 : Pre-harvest spray of calcium nitrate, calcium chloride and potassium sulphate on Total soluble solids (°Brix), Titrable acidity (%),Reducing sugar (%) and Total Sugars (%)aonla *(Emblica officinalis* Gaertn) fruits cv. Hathijhool.

Treat-ments	Total soluble solids (oBrix)				Titrable acidity (%)				Reducing sugar (%)				Total Sugars (%)			
	0 day	5 days	10 days	15 days	0 day	5 days	10 days	15 days	0 day	5 days	10 days	15 days	0 day	5 days	10 days	15 days
T_0	12.23	12.33	12.48	12.68	1.72	1.69	1.67	1.64	3.14	3.23	3.28	3.36	5.32	5.55	5.71	5.82
T_1	12.63	12.77	12.90	13.00	1.84	1.82	1.81	1.80	3.26	3.33	3.42	3.56	5.48	5.76	5.90	6.11
T_2	12.67	12.87	12.97	13.10	1.92	1.90	1.88	1.87	3.32	3.40	3.55	3.71	5.61	5.95	6.23	6.40
T_3	12.37	12.53	12.67	12.87	1.82	1.80	1.78	1.76	3.30	3.38	3.50	3.63	5.54	5.80	5.95	6.18
T_4	12.53	12.70	12.87	13.07	1.83	1.82	1.80	1.78	3.20	3.27	3.32	3.39	5.41	5.63	5.78	5.98
T_5	12.60	12.80	13.00	13.13	1.90	1.89	1.87	1.86	3.29	3.34	3.49	3.57	5.55	5.79	5.93	6.15
T_6	12.47	12.67	12.83	12.93	1.88	1.87	1.86	1.84	3.25	3.34	3.44	3.54	5.49	5.64	5.81	5.99
T_7	12.70	12.83	12.93	13.03	1.82	1.80	1.72	1.69	3.31	3.42	3.56	3.70	5.62	6.00	6.28	6.45
T_8	12.90	13.03	13.13	13.27	1.87	1.86	1.84	1.83	3.33	3.46	3.57	3.70	5.76	6.10	6.32	6.49
T_9	12.40	12.50	12.63	12.80	1.89	1.88	1.86	1.84	3.33	3.47	3.58	3.72	5.78	6.12	6.33	6.53
S.Em.±	0.04	0.06	0.04	0.05	0.01	0.01	0.03	0.03	0.03	0.01	0.008	0.03	0.04	0.03	0.05	0.07
CD at 5%	0.14	0.18	0.14	0.14	0.05	0.05	0.11	0.11	0.11	0.03	0.024	0.11	0.12	0.10	0.16	0.22

maintaining marketable fruits and edible quality of fruits had been also reported by (2, 8, 9) in aonla (13, 15) in guava.

Total soluble solids (^{o}Brix) : There was increase in total soluble solids content up to 5th day of storage in all the treatments including control and thereafter significant variation seen in treated and untreated fruits. The maximum TSS (12.90, 13.03, 13.13 and 13.27 ^{o}Brix) on 0th, 5th, 10th and 15th days of storage period respectively was recorded with the application 1.5% @ Potassium sulphate (T_8). Which was followed by T_7 (12.70, 12.83, 12.93 and 13.03 ^{o}Brix) on 0th, 5th, 10th and 15th days, respectively.

The possible reason of increase in TSS is adequate scope of nutrients to the plant, which hydrolyzed starch into sugar and helpful to increase the TSS of fruit. A higher increase in TSS content with foliar application of potassium is related with role of potassium in translocation of sugar from leaves to fruits, which results better quality fruits in term of total soluble solid. A marked influence in total soluble solid by these nutrients in current study is supported by (16, 17) in pear cv. Pathernakh, (13) in guava cv. Chittidar.

Acidity (%) : The acidity initially increased on 5th day storage. The maximum per cent acidity (1.92, 1.90, 1.88 and 1.87%) on 0th, 5th, 10th and 15th day was recorded with the application calcium nitrate @ 1.5% (T_2). The initial increase in acidity might be due to the start of anaerobic respiration thereafter the decrease in acidity during storage could be attributed to the conversion of acids into salt and sugars by the enzymes particularly invertase. Since the juice became concentrated (loss of moisture during storage) the increase in per cent acidity was obvious. Similar result are also reported by (2, 5, 6, 8, 9, 10, 18) in aonla.

Sugars (Total sugars and reducing sugar %) : Total sugars and reducing sugar increased up to 5th day of storage at room temperature followed by a decreased there after. The maximum total sugars (5.78, 6.12, 6.33 and 6.53%) on 0th, 5th,10th and 15th days of storage period, respectively was recorded with the application of potassium sulphate @ 2% (T_9). The maximum reducing sugar (3.33, 3.47, 3.58 and 3.72% on 0th, 5th, 10th, and 15th days of storage period, respectively was recorded in T_9. The initial increase might be due to the conversion of starch in to simple sugars and the decrease later could possibly be due to utilization of these sugars in respiration during storage. Application of chemicals retained higher sugars content over control during storage. They might have reduced the rate of respiration and delayed the onset of senescence. Similar result are also reported by (2, 8, 9) in aonla. (19) in pear cv. (13) in guava cv. Chittidar.

Conclusion

It can be concluded that calcium nitrate and potassium sulphate improve the shelf-life and quality of aonla fruits cv. 'Hathijhool at room temperature.

References

1. NHB (2017). Area and production estimates for horticultural crops. National Horticulture Board, Government of India, Gurgaon, India.
2. Gangwar S., Shukla H.S., Katiyar D. and Pandey V. (2012). Effect of calcium nitrate on physico-chemical changes and shelf-life of aonla (*Emblica officinalis gaertn)* Fruits. *Horti. Flora Res. Spectrum.* 1(3): 253–258.
3. Deshmukh P.H., Pacharne D.P. and Bhute N.K. (2021). Standardization of Potash Levels and Apportioning Time in Summer Ground nut under Drip Irrigation. *Frontiers in Crop Improvement*, 9(2): 133-135.
3. Ranganna S. (1977). Manual of analysis of fruit and vegetable products. *Tata McGraw Hill Publishing Co. Pvt. Ltd.,* New Delhi. Pp. 9-13.

4. Nelson N. (1944). A photometric adoption of the somogui method for the determination of glucose. *J. Bio. Chem*. (153): 375-380.
5. Dhumal S.S., Karal A.R., Garande V.K., Patil B.T., Masalkar S.D. and Kshirsagar, D.B. (2008). Shelf-life of aonla fruits; Influenced by post-harvest treatment and packaging materials. *Indian J. of Agri. Res.* 42(3): 189-194.
6. Kumar P. and Singh H.K. (2009). Effect of pre-harvest Spray of chemicals to check decay loss in aonla fruits during storage at ambient temperature. *Haryana J. Horti. Sci.* 38 (1&2): 43-45.
7. Yadav S. and Shukla H.S. (2009). Effect of various concentrations of plant growth regulators and mineral nutrient on quality parameters and Shelf-life of aonla (*Emblica officinalish* Gaertn) fruits. *Indian J. Agri. Bio. Chem.* 22 (1): 51-56.
8. Bisen S., Jain P.K. and Thakur R.S. (2010). Effect of various pre-harvest treatments on yield, quality and shelf-life of aonla fruits. *JNKVV Res. J.* 44(2): 157-161.
9. Lodhi D.K. and Tiwari R. (2017). Effect of calcium nitrate on physico-chemical changes and shelf-life of aonla (*Emblica officinalis* Gaertn) fruits. *Annals of Plant and Soil Res.* 19(1): 32-36.
10. Singh A.K., Shukla H.S., Kumar H., Singh V. and Singh R.R. (2014). Effect of gibberelic acid and calcium nitrate on the physiological and physico-chemical changes and shelf-life of aonla (*Emblica officinalis* Gaertn) fruits. *Int. J. Farm Sci*., 5(2): 140-145.
11. Gupta N. and Singh V.B. (2016). Pre-harvest foliar application of calcium chloride bavistin and bayleton on post harvest life of *Emblica officinalis* Gaertn. Fruits. *Bangladesh J. Bot.* 45(1): 211-219.
12. Ali F.S. (2014). Studies of some pre harvest treatments on growth and fruit quality of guava fruits. *J. Agri. Veterinary Sci*., 7(12): 12-21.
13. Nagar D., Kanpure R.N., Tiwari R. and Bhandari J. (2018). Effect of pre-harvest spray of alar, calcium chloride and potassium sulphate on post-hravest behavior guava fruits. cv. Chittidar. 8(D*): 2277-7601.*
14. Mishra D.S., Tiwari J.P., Mishra K.K. and Lal S. (2003). Effect of calcium nitrate and method of application on nutrient content of leaves and post harvest quality of guava fruits. *Scientific Horti.* 8: 11-19.
15. Hiwale S.S. and Singh S.P. (2003). Prolonging the shelf-life of guava (*Psidium guajava* L.). *Indian J. Hort.* 60: 1-9.
16. Gill P.P.S., Ganaie M.Y., Dhillon W.S. and Singh N.P. (2012). Effect of foliar sprays of potassium on fruit size and quality of Patharnakh pear. *Indian J. of Horti*., 69(4): 512-516.
17. Prasad B., Dimri D.C. and Bora L. (2016). Effect of pre-harvest spray of calcium and potassium on fruit physical attributes and yield of pear cv. Pathernakh. *Environ. and Eco*., 34(3): 997-1000.
18. Jhilick Banerjee, Ankita Sharma and Yogendra Singh and S.P. Singh (2021). Nutritional enhancement in legumes using recent plant breeding and biotechnological approaches. *Frontiers in Crop Improvement,* 9(2): 85-90.
19. Prasad B., Dimri D.C. and Bora L. (2015). Effect of pre-harvest foliar spray of calcium and potassium on fruit quality of pear cv. Pathernakh. *Academic J.* 10(11): 376-380.