

## Original Research Article

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## Studies on Extending the Shelf Life of Fig (*Ficus carica* L.) Fruits Cv. Poona Fig

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### ABSTRACT

The present investigation entitled, “Studies on extending the shelf life of Fig (*Ficus Carica* L.) fruits Cv. Poona Fig” was conducted at Department of Horticulture, Late Shri Vasant Rao Naik Marathwada Krishi Vidyapeeth, Parbhani, M.S., India during the year 2014-15. The experiment was conducted in Factorial Completely Randomized Design (FCRD) with six pre-harvest treatments and two storage conditions. The treatments were replicated three times. The preharvest sprays (0.5%, 1.0% and control) were undertaken 10 and 20 days before harvesting fruits of Fig Cv. Poona fig. The fruits were packed in CFB boxes and stored under two environments viz. at room temp. (15.10 to 41.3<sup>0</sup>C and 49.00 – 71.00% RH) and in cool store (5<sup>0</sup>C and 90-95% RH). The results revealed that there was an increase in TSS, reducing sugars and total sugars with corresponding decrease in acidity of fig Cv.Poona fig fruits under both the storage conditions irrespective of pre-harvest treatments. Fruits stored in cool store followed the same trend of physico-chemical changes but at a slower rate. The shelf life of control fig fruits was found to be hardly 2 days at room temperature. However fig fruits of variety Cv. Poona fig could be stored upto 40 days at room temperature when these were given spray of CaCl<sub>2</sub> (1.0%) 10 days before harvesting. The shelf life of untreated fruits of both these varieties was hardly 5 days in CS. However, it could be further extended upto 8 days when given spray of CaCl<sub>2</sub>(1.0%) 10 days before harvesting and stored in CS.

#### Keywords

Pre-harvest spray, Room temperature, Cool storage, Shelf life, Fig fruits)

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### Introduction

Fig (*Ficus carica* L.) belongs to family moraceae. The main Fig growing countries are Italy, Spain, Turkey, Greece, Portugal and Algeria. It is extensively grown in the state of California (USA) and Afghanistan. Total area under Fig cultivation in India is about 5600 hectares with the production of 13,802

thousand tonnes i.e. about 12.32 tonnes per hectare (Anon., 2018). In Maharashtra, it is cultivated on commercial scale in adjoining area of Pune and Aurangabad districts.

The principle causes for postharvest losses are infection by pathogen, rough handling, improper packaging, improper mode of transportation and unhygienic storage

conditions. It is estimated that the total losses due to spoilage may be ranging from 30-40 per cent and (Salunke and Desai, 1984). The research efforts have helped to increase the production of Fig fruit but the purpose of obtaining maximum profit will not be served unless increased production is supplemented with similar efforts to minimize their post harvest losses. Calcium has received considerable attention in recent years due to its desirable effects particularly it can delay ripening and senescence, increase firmness, vitamin C and phenolic contents, reduce respiration, extend storage life and reduce the incidence of physiological disorders and storage rots. Calcium treatments have known to delay softening and improve the fruits quality. The variety such as Poona Fig has been found to give high yield with more total soluble solids. Cool storage of Fig fruits is an expensive method and has not been widely adopted by many growers.

The information on both such as pre-harvest spray of calcium chloride and use of cool storage for extending the shelf life of Fig fruits Cv.Poona fig that are grown under arid conditions is not available. Therefore the present investigation was undertaken with the objectives to study the effect of pre-harvest sprays of calcium chloride on the changes in physico-chemical characteristics of Fig fruits under various storage conditions.

### **Materials and Methods**

The present investigation was conducted at the Post Harvest Technology Laboratory of the Department of Horticulture, Vasantrao Naik Marathwada Krishi Vidyapeeth, Parbhani during the year 2014-15 to study the effect of pre-harvest spray of calcium chloride on the changes in physico-chemical characteristics of Fig fruits under various storage conditions. The experiment was conducted in Factorial Completely

Randomized Design (CRD) with six pre-harvest treatments and two storage conditions.

The treatments were replicated three times. The sprays of calcium chloride at 20 and 10 days before harvesting of Fig Cv. Poona Fig were undertaken and different concentrations of calcium chloride were applied as pre-harvest sprays which are T<sub>1</sub>-0.5% CaCl<sub>2</sub>-10 days before harvesting, T<sub>2</sub>-0.5% CaCl<sub>2</sub>-20 days before harvesting, T<sub>3</sub>-1.0% CaCl<sub>2</sub>-10 days before harvesting, T<sub>4</sub>-1.0% CaCl<sub>2</sub>-20 days before harvesting, T<sub>5</sub>-control (water sprayed) - 10 days before harvesting and T<sub>6</sub>-control (water sprayed) - 20 days before harvesting.

The fruits of above treatments were harvested early in the morning at proper stage of maturity and graded. The Fig fruits were then packed in Corrugated Fiberboard Boxes (CFB) and stored under various environments and room temperature (15.10 – 41.3<sup>0</sup>C and 49.00 – 71.00% RH) and low temperature (5<sup>0</sup>C and 90 – 95% RH). For chemical analysis, the sample was first ground finely in mixer and then homogenized in mortar and pestle for obtaining pulp of uniform consistency. The pulp was analyzed for the content of TSS, acidity, total sugars and reducing sugars.

The contents of TSS (%) in fresh Fig fruits were determined with the help of hand refracto meter and the values were corrected to 20<sup>0</sup>C with the help of temperature correlation chart (A.O.A.C., 1975). Total titrable acidity of the pulp was determined as per the method advocated by A.O.A.C.(1975). The reducing and total sugars (%) were estimated as per the method given by Lane and Eynon (1923). Analysis of variance for all characters was done as per the method of analysis of variance using Factorial Completely Randomized Block Design given by Snedecor and Cochran (1994).

## **Results and Discussion**

### **Total Soluble Solids (TSS)**

The data on the effect of preharvest sprays of CaCl<sub>2</sub> on changes in total soluble solids (per cent) of Fig fruits Cv.Poona Fig during storage at RT have been given in Table 1. At the beginning of the storage, the value for TSS of Fig fruits Cv.Poona Fig were found to be 19.38, 19.25, 19.69, 19.80 and 20.00 per cents for T<sub>1</sub>, T<sub>2</sub>, T<sub>3</sub>, T<sub>4</sub>, T<sub>5</sub> and T<sub>6</sub> respectively. The values of TSS of Fig fruits at the end of 4<sup>th</sup> day of storage at RT were found to be 21.91, 22.28, 21.20, 21.42, 22.57 and 22.67 percents for the treatment T<sub>1</sub>, T<sub>2</sub>, T<sub>3</sub>, T<sub>4</sub>, T<sub>5</sub> and T<sub>6</sub> respectively.

The data on the effect of pre-harvest sprays of CaCl<sub>2</sub> on changes in total soluble solids (per cent) of Fig fruits Cv.Poona Fig during storage at CS have been given in Table 2. Initially values for TSS of Fig fruits Cv.Poona Fig were found to be 19.38, 19.25, 19.69, 19.80 and 20.00 per cent for T<sub>1</sub>, T<sub>2</sub>, T<sub>3</sub>, T<sub>4</sub>, T<sub>5</sub> and T<sub>6</sub> respectively. At the end of 8<sup>th</sup> day of storage in CS, the TSS was found to be the lowest in T<sub>3</sub> (21.47%) while the highest in T<sub>6</sub> (22.69%). The values of TSS were found to be 21.69, 21.79, 21.47, 21.64, 22.56 and 22.69 per cents for the treatments T<sub>1</sub>, T<sub>2</sub>, T<sub>3</sub>, T<sub>4</sub>, T<sub>5</sub> and T<sub>6</sub> respectively.

The increase in TSS of Fig fruits could be attributed to the conversion of reserved starch and other insoluble carbohydrates into soluble sugars as Fig fruits is climactic fruit. These results elucidate the findings of Kardum (2004) in Fig under cold storage condition and Lakshamana and Reddy (1999) in Sapota fruits.

### **Acidity**

It was revealed from data presented in Table 1 that at the beginning of the storage at RT, the

values for acidity of fig fruits Cv. Poona Fig were found to be 0.200, 0.193, 0.213, 0.206, 0.186 and 0.183 per cents for T<sub>1</sub>, T<sub>2</sub>, T<sub>3</sub>, T<sub>4</sub>, T<sub>5</sub> and T<sub>6</sub> respectively. The values of acidity of Fig fruits Cv.Poona Fig after 4<sup>th</sup> day of storage period at RT, were found to be 0.172, 0.170, 0.192, 0.176, 0.163 and 0.161 per cents for the treatments T<sub>1</sub>, T<sub>2</sub>, T<sub>3</sub>, T<sub>4</sub>, T<sub>5</sub> and T<sub>6</sub> respectively.

The data recorded in Table 2 indicated that at the beginning of the storage, the values for acidity of Fig fruits Cv.Poona fig were found to be 0.200, 0.193, 0.213, 0.206, 0.186 and 0.183 per cents for the treatments T<sub>1</sub>, T<sub>2</sub>, T<sub>3</sub>, T<sub>4</sub>, T<sub>5</sub> and T<sub>6</sub> respectively. The values of acidity of Fig fruits Cv.Poona Fig at the 8<sup>th</sup> day of storage in CS were found to be 0.163, 0.152, 0.179, 0.172, 0.150 and 0.142 per cents for the treatments T<sub>1</sub>, T<sub>2</sub>, T<sub>3</sub>, T<sub>4</sub>, T<sub>5</sub> and T<sub>6</sub> respectively.

The acidity of Fig fruits generally decreased with advancement of storage period (Salunke and Desai, 1984). Decrease in acidity may be attributed to conversion of acids into sugars during respiration. These results are in confirmation with the findings of Kardum (2004) in Fig.

### **Reducing sugars (per cent)**

The data on the effect of CaCl<sub>2</sub> on changes in reducing sugars (per cent) of Fig fruits Cv.Poona Fig during storage at RT have been given in Table 1. At the beginning of the storage, the values for reducing sugars of Fig fruits were found to be 13.28, 12.80, 13.39, 12.97, 13.75 and 13.86 per cents for the treatments T<sub>1</sub>, T<sub>2</sub>, T<sub>3</sub>, T<sub>4</sub>, T<sub>5</sub> and T<sub>6</sub> respectively. The values of reducing sugars of Fig fruits at the end of 4<sup>th</sup> day of storage period were found to be 14.56, 15.08, 14.44, 14.74, 15.21 and 15.57 per cents for the treatments T<sub>1</sub>, T<sub>2</sub>, T<sub>3</sub>, T<sub>4</sub>, T<sub>5</sub> and T<sub>6</sub> respectively.

**Table.1** Effect of pre-harvest sprays of CaCl<sub>2</sub> on physico-chemical characteristics of Fig fruits Cv.Poona Fig during storage at Room Temperature (R.T.)

Treatment No	Days after storage							
	TSS (%)		Acidity (%)		Reducing Sugar (%)		Total Sugar (%)	
	Initial (0)	4 DAS	Initial (0)	4 DAS	Initial (0)	4 DAS	Initial (0)	4 DAS
<b>T<sub>1</sub></b>	19.38	21.91	0.200	0.172	13.28	14.56	15.68	17.88
<b>T<sub>2</sub></b>	19.25	22.28	0.193	0.170	12.80	15.08	15.62	18.08
<b>T<sub>3</sub></b>	19.69	21.20	0.213	0.192	13.39	14.44	15.36	17.48
<b>T<sub>4</sub></b>	19.49	21.42	0.206	0.176	12.97	14.74	16.06	17.68
<b>T<sub>5</sub></b>	19.80	22.57*	0.186	0.163*	13.75	15.21*	16.52	18.68*
<b>T<sub>6</sub></b>	20.00	22.67*	0.183	0.161*	13.86	15.75*	16.72	18.88*
<b>T<sub>7</sub></b>	19.60	22.00	0.197	0.174	13.34	14.93	15.99	18.11
<b>Pre-harvest treatment</b>	SE±	CD at 5%	SE±	CD at 5%	SE±	CD at 5%	SE±	CD at 5%
	0.02356	0.06665	0.00143	0.00404	0.03348	0.09472	0.03300	0.09335
<b>Storage period</b>	0.02581	0.07301	0.00156	0.00442	0.03668	0.10376	0.03615	0.10226
<b>Pre-harvest treatment X Storage period</b>	0.05771	0.16325	0.00350	0.00989	0.08201	0.23200	0.08083	0.22865

\* Storage life terminated

**Table.2** Effect of pre-harvest sprays of CaCl<sub>2</sub> on physico-chemical characteristics of Fig fruits Cv.Poona Fig during storage at Cool Storage (CS)

Treatment No.	Days after storage							
	TSS (%)		Acidity (%)		Reducing Sugar (%)		Total Sugar (%)	
	Initial (0)	8 DAS	Initial (0)	8 DAS	Initial (0)	8 DAS	Initial (0)	8 DAS
<b>T<sub>1</sub></b>	19.38	21.69	0.200	0.163	13.28	15.22	15.68	18.36
<b>T<sub>2</sub></b>	19.25	21.79	0.193	0.152	12.80	15.13	15.62	18.55
<b>T<sub>3</sub></b>	19.69	21.47	0.213	0.179	13.39	14.80	15.36	18.12
<b>T<sub>4</sub></b>	19.49	21.64	0.206	0.172	12.97	15.06	16.06	18.58
<b>T<sub>5</sub></b>	19.80	22.56*	0.186	0.150*	13.75	15.71*	16.52	20.18*
<b>T<sub>6</sub></b>	20.00	22.69*	0.183	0.142*	13.86	15.79*	16.72	19.38*
<b>Mean</b>	19.60	21.97	0.197	0.159	13.35	15.28	15.99	18.86
<b>Pre-harvest treatment</b>	SE±	CD at 5%	SE±	CD at 5%	SE±	CD at 5%	SE±	CD at 5%
	0.00495	0.01388	0.00111	0.00311	0.03845	0.10777	0.03327	0.09326
<b>Storage period</b>	0.00404	0.01133	0.00091	0.00254	0.03139	0.08799	0.02716	0.07615
<b>Pre-harvest treatment X Storage period</b>	0.01213	0.03400	0.00272	0.00763	0.09417	0.26398	0.08149	0.22843

\* Storage life terminated

The data presented in Table 2 indicated that at CS initially, the values for reducing sugars of Fig fruits Cv.Poona fig were found to be 13.28, 12.80, 13.39, 12.97, 13.75 and 13.86 per cents for the treatments T<sub>1</sub>, T<sub>2</sub>, T<sub>3</sub>, T<sub>4</sub>, T<sub>5</sub> and T<sub>6</sub> respectively. The values of reducing sugars on 8<sup>th</sup> day of storage in CS were found to be 15.22, 15.13, 14.80, 15.06, 15.71 and 15.79 per cents for the treatments T<sub>1</sub>, T<sub>2</sub>, T<sub>3</sub>, T<sub>4</sub>, T<sub>5</sub> and T<sub>6</sub> respectively.

The rate of increase in sugar was found to be faster at RT than in CS. It could possibly be due to the fact that higher temperature and low humidity resulted in faster utilization of sugar at RT resulted in shorter shelf life of Fig fruits. Similar reports were given by Khedkar (1998) for pomegranate.

### **Total sugar (per cent)**

From the data presented in Table 1, it was revealed that initially, the values for total sugars of fig fruits Cv. Poona Fig were found to be 15.68, 15.62, 15.36, 16.06 and 16.72 per cent for the treatments T<sub>1</sub>, T<sub>2</sub>, T<sub>3</sub>, T<sub>4</sub>, T<sub>5</sub> and T<sub>6</sub> respectively.

The values of total sugars of Fig fruits Cv.Poona Fig at the end of 4<sup>th</sup> day of storage period at RT were found to be 17.88, 18.08, 17.48, 17.68, 18.68 and 18.88 per cent for the treatments T<sub>1</sub>, T<sub>2</sub>, T<sub>3</sub>, T<sub>4</sub>, T<sub>5</sub> and T<sub>6</sub> respectively.

From the data presented in Table 2 it was revealed that at CS initially, the values for total sugars of Fig fruits Cv.Poona Fig were found to be 15.68, 15.62, 15.62, 15.36, 16.06, 16.52 and 16.72 per cents for the treatments T<sub>1</sub>, T<sub>2</sub>, T<sub>3</sub>, T<sub>4</sub>, T<sub>5</sub> and T<sub>6</sub> respectively. The values of total sugars of Fig fruits Cv.Poona Fig at the end of 8<sup>th</sup> day of storage period were found to be 18.36, 18.55, 18.12, 18.58, 20.18 and 19.38 per cents respective for the treatment T<sub>1</sub>, T<sub>2</sub>, T<sub>3</sub>, T<sub>4</sub>, T<sub>5</sub> and T<sub>6</sub>.

The continuous rise of total sugar of Fig fruits Cv.Poona fig was observed under both the storage conditions. The rate of increase of total sugar was found to be faster at RT than in CS. It could possibly be due to the fact that higher temperature and low humidity resulted in faster utilization of soluble solids and sugars at RT resulted in shorter life of fig fruits. These changes were found to be at slower rate when fruits were stored in CS. Similar reports were given by Kardum (2004) for fig and Khedkar (1998) for pomegranate. Exogenous Ca<sup>++</sup> has been shown to delay senescence of many fruits tissue slices, in particular ethylene production and the onset of lipid peroxidation (Sharma *et al.*, 1996).

In conclusion the use of calcium chloroxide as pre-harvest spray and cool storage could be used in order to extend the shelf life of fresh fig fruits. Use of cool storage is helpful in maintaining the physico-chemical characteristics of fig fruits.

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