



## Research Article

# EFFECTS OF SILICON SOURCES AND SALICYLIC ACID ON QUALITY AND SHELF LIFE OF MANGO FRUITS (*Mangifera indica* L.) cv. KESAR

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**Abstract-** A study was conducted at RHRS farm, Navsari Agricultural University, Navsari during the year 2016-17 to investigate the effect of different silicon sources and salicylic acid on quality of mango fruits cv. Kesar. The experiment was laid out in a Randomized Block Design with ten treatments and replicated thrice. Trees were subjected to foliar sprays of potassium silicate (1, 2 and 3 ml/l), silicic acid (2, 3 and 4 ml/l), salicylic acid (1500, 2000 and 2500 ppm) and unsprayed control. Result indicated a significant impact of treatments on all parameters included in the study except total carotenoid content. Trees sprayed with salicylic acid at 2000 ppm recorded the highest TSS (19.40°Brix), total sugar content (24.83%), reducing sugars (4.87%) and non-reducing sugars (19.96%) after 16 days of storage under ambient conditions. For that very storage period, salicylic acid @2000 ppm had the minimum PLW (19.20%) and titrable acidity (0.193%). Fruit treated with salicylic acid could be kept for about 18 days without any apparent loss in quality. This study high lights the possibility of using salicylic acid at 2000 ppm for improving fruit quality and enhancing shelf life of mango fruits cv. Kesar.

**Key words-** Mango, Salicylic acid, Silicic acid, Potassium silicate, TSS, shelf life.

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## Introduction

Mango (*Mangifera indica*) occupies a place of pride in the Indian subcontinent and its cultivation can be traced back to 4000 BC [1]. On account of its delicious taste, rich flavor and nutritional value, mango is regarded as the “King of Tropical Fruits” in India. Owing to diverse agroclimatic conditions, rich basket of varieties and sound management of orchards, India is the largest consumer and producer of mango in the world accounting for about 45.1% of the total global production [2]. Mango covers an area of 2516 thousand ha with a production of 18431.3 thousand Metric Tonnes (MT) at the national level. Gujarat produces about 1125.61 thousand MT of mangoes from an area of 142.69 thousand ha and a productivity of 7.9 MT/ha [2]. Mango is chiefly cultivated in the districts of Valsad, Navsari, Bharuch, Rajkot, Jamnagar, Kutchh and Junagadh because of favorable agro-climatic condition. Kesar, Alphonso, Rajapuri, Totapuri, Dadamiyo, Jamadar, VashiBadami, Dashehari, Langra, Karanjiyo, Sardar and Neelum are some mango varieties grown on a commercial scale in Gujarat. Kesar is the most well known mango variety of Gujarat, prized for its exquisite flavour and taste.

Kesar is blessed with high yield potential, is regular in bearing, has good consumer's acceptance, medium in size with sweet fibreless flesh, excellent sugar, attractive shape, size and saffron colored pulp with very good keeping quality. Kesar mango is the pride of Gujarat and has carved out a name for it in domestic as well as foreign markets.

Salicylic acid is considered as an endogenous plant growth regulator due to its stimulatory effect on growth, flowering, fruiting and yield. At low concentration, it induces formation of female flowers, improves production and enhances inherent plant resistance against diseases thereby prolonging shelf life of the produce.

Srivastava and Dwivedi [3], Zganget al. [4], Shaabanet al. [5] and Ahmed et al. [6] have provided experimental evidence to prove the beneficial effects of using salicylic acid on growth and fruiting in an array of fruit crops.

Silicon is not considered as essential nutrient, but it is typically abundant in soils and can be taken up in large amounts by plants. It reportedly enhances resistance against pest and diseases, structural fortification and regulation of the uptake of other ions. The importance of using silicon sources on growth and bearing of different fruit crops was highlighted in earlier works by Kanto [7], Qin and Tian [8] and Gad El-Kareem et al. [9]. Most importantly, silicon supplementation improved the ability of mango trees to withstand environmental stress when grown in arid regions [10]

Looking to the involvement of salicylic acid and silica in growth and development, it was felt necessary to explore the effect of their exogenous application on fruit quality and shelf life in mango cultivar ‘Kesar’.

## Materials and Methods

The present study was conducted during 2016-17 on mango cultivar ‘Kesar’ planted at 10m x 10m at the experimental orchard of Regional Horticultural Research Station, Navsari Agricultural University, Navsari, Gujarat. The experiment was laid out in Randomized Block Design (RBD) with three replication and ten treatments namely Control, Potassium silicate @1ml/l, Potassium silicate @2ml/l, Potassium silicate @3ml/l, Silicic acid @2ml/l, Silicic acid @3ml/l, Silicic acid @4ml/l, Salicylic acid (1500 ppm), Salicylic acid (2000 ppm) and Salicylic acid (2500 ppm). Foliar spray of silicon and salicylic acid was carried out at pea and marble stage. Twenty year's old grafted trees of mango cv. Kesar, were

selected for this study. Five mature fruits of uniform size and shape were selected for taking observations. Fruits were washed with tap water, dried and kept in laboratory at ambient temperature (30±5°C and 50±5 % RH) in Corrugated Fibre Board (CFB) boxes. The Physiological Loss in Weight (PLW) was determined by the following formula and expressed as percentage.

$$PLW (\%) = \frac{\text{Initial weight of fruit (g)} - \text{Final weight (g)}}{\text{Initial weight (g)}} \times 100$$

The numbers of days taken from harvesting to optimum eating stage were regarded as the shelf life of fruits. Fruit quality parameters were recorded every fourth day from the day of harvesting till the end of shelf life. Total soluble solids were measured by using Erma hand refractometer (range 0-32°Brix). Estimation of reducing sugars (%), total sugars (%), titrable acidity (%), ascorbic acid content (mg/100g pulp) and total carotenoid (mg/100g pulp) were estimated as per method of Lane and Eynon described by Ranganna [11]. Non-reducing sugars (%) were estimated by subtracting reducing sugars from total sugars. The data collected for all the characters involved under study were subjected to statistical analysis as per the method suggested by Panse and Sukhatme [12] using Statistical Package for Agricultural Scientists (OPSTAT) software [13].

**Results and Discussion**

Results deduced from the present investigation as well as relevant discussion have been summarized under the following heads:

**Physiological Loss in Weight and Shelf life**

Results indicated that the physiological loss in weight (%) and shelf life (days) of mango cv. Kesar were significantly influenced by the application of silicon and salicylic acid [Table-1]. The data indicated that, minimum loss in weight right from the 1<sup>st</sup> day of storage up to 16<sup>th</sup> day occurred consistently in fruits treated with salicylic acid @2000 ppm. This was at par with remaining two levels of salicylic acid (1500 and 2500 ppm). Similarly, fruits treated with salicylic acid @2000 ppm had maximum shelf life (18.00 days). This was at par with salicylic acid at the rate of 2500 ppm, 1500 ppm and potassium silicate@ 1 ml/l.

The reduced loss in weight due to application of salicylic acid might be attributed to suppression and reduction in respiration and transpiration rates of mango fruits by closing the lenticels of treated fruits, which ultimately influences the shelf life. Moreover, regarding shelf life, application of salicylic acid increases fruit firmness [14] by decreasing the activity of cell wall degrading enzyme like cellulose, polygalacturonase and xylanase. Salicylic acid also interferes with biosynthesis and/ or action of ethylene [15] thereby increasing shelf life. Another important factor for increasing shelf life of mango fruits is the ability of salicylic acid to induce Systematic Acquired Resistance (SAR) providing considerable protection against

abiotic stresses. Salicylic acid suppressed postharvest diseases caused by *Colletotrichum gloeosporioides* in mango fruit [16] and reduced post-harvest diseases in pear [17]. The findings of Ngullie et al. [18] and Reddy and Sharma [19] in mango, Srivastava and Dwivedi [3] in banana, Cao et al. [17] in pear are in confirmation with the present investigation.

**Table-1** Effect of silicon and salicylic acid on physiological loss in weight and shelf life of mango cv. Kesar

Treatments	PLW (%)					Shelf life (days)
	1 <sup>st</sup> day	4 <sup>th</sup> day	8 <sup>th</sup> day	12 <sup>th</sup> day	16 <sup>th</sup> day	
T <sub>1</sub> : Control		6.24	10.46	16.62	—	12.20
T <sub>2</sub> : Potassium silicate @ 1 ml/l		3.83	8.37	13.14	22.37	16.80
T <sub>3</sub> : Potassium silicate @ 2 ml/l		4.08	8.51	13.15	—	14.60
T <sub>4</sub> : Potassium silicate @ 3 ml/l		4.11	8.98	13.39	—	14.40
T <sub>5</sub> : Silicic acid @ 2 ml/l		5.97	9.12	13.83	—	13.30
T <sub>6</sub> : Silicic acid @ 3 ml/l		6.18	9.49	15.70	—	13.20
T <sub>7</sub> : Silicic acid @ 4 ml/l		6.07	8.99	14.75	—	13.00
T <sub>8</sub> : Salicylic acid (1500 ppm)		3.81	8.35	13.11	20.52	17.20
T <sub>9</sub> : Salicylic acid (2000 ppm)		3.76	8.26	12.75	19.20	18.00
T <sub>10</sub> : Salicylic acid (2500 ppm)		3.78	8.32	13.09	19.57	17.30
SEm. ±		0.28	0.41	0.75	0.65	0.58
CD at 5%		0.84	1.23	2.23	2.23	1.74
CV %		10.20	8.08	9.34	5.47	6.75

Decrease in physiological loss in weight and increase in shelf life by foliar spray of silicon might be due to the impact of silicon on suppression of respiration and reduction in ethylene evolution. This may have minimized physiological loss in weight and ultimately increased the shelf life. The findings of Vidya et al. [20] in mango and Lalithya et al. [21] in sapota are in confirmation with the present investigation.

**Total Soluble Solids (TSS)**

There was a gradual increase in TSS during the storage period under all treatments [Table-2]. Treatments failed to elicit a significant response from total soluble solids on the 1<sup>st</sup> and 4<sup>th</sup> day of storage. However, silicon and salicylic acid had a significant influence on TSS on 8<sup>th</sup>, 12<sup>th</sup> and 16<sup>th</sup> day of storage. The highest TSS (11.77 and 17.50°Brix) was recorded in T<sub>7</sub> (silicic acid 4ml/l) on the 8<sup>th</sup> and 12<sup>th</sup> day of storage which was at par with T<sub>5</sub> (11.67°Brix) and T<sub>4</sub> (11.00°Brix) on 8<sup>th</sup> day of storage and with treatment T<sub>5</sub> (17.07°Brix), T<sub>4</sub> (17.00°Brix), T<sub>3</sub> (16.97°Brix), T<sub>6</sub> (16.67°Brix) and T<sub>1</sub> (16.33°Brix) on the 12<sup>th</sup> day of storage, respectively. TSS was the highest (19.40°Brix) under salicylic acid @2000 ppm on the 16<sup>th</sup> day of storage which was at par with treatment T<sub>10</sub> (18.56°Brix).

**Table-2** Effect of silicon and salicylic acid on total soluble solids and total sugars in mango cv. Kesar.

Treatments	Total Soluble Solids (°Brix)					Total sugars (%)				
	1 <sup>st</sup> day	4 <sup>th</sup> day	8 <sup>th</sup> day	12 <sup>th</sup> day	16 <sup>th</sup> day	1 <sup>st</sup> day	4 <sup>th</sup> day	8 <sup>th</sup> day	12 <sup>th</sup> day	16 <sup>th</sup> day
T <sub>1</sub> : Control	5.60	7.37	8.23	16.33	—	7.43	9.23	11.10	18.57	—
T <sub>2</sub> : Potassium silicate @ 1 ml/l	5.70	8.67	10.60	14.67	17	7.63	11.03	13.03	18.40	19.73
T <sub>3</sub> : Potassium silicate @ 2 ml/l	5.77	8.47	9.63	16.97	—	7.73	10.77	13.20	19.30	—
T <sub>4</sub> : Potassium silicate @ 3 ml/l	6.30	8.57	11.00	17.00	—	8.27	11.07	13.80	19.17	—
T <sub>5</sub> : Silicic acid @ 2 ml/l	6.50	8.77	11.67	17.07	—	8.53	11.10	14.37	19.77	—
T <sub>6</sub> : Silicic acid @ 3 ml/l	6.57	8.57	10.73	16.67	—	8.57	10.93	13.53	19.13	—
T <sub>7</sub> : Silicic acid @ 4 ml/l	5.63	8.67	11.77	17.50	—	7.63	11.14	14.67	20.17	—
T <sub>8</sub> : Salicylic acid (1500 ppm)	6.40	8.47	9.77	14.00	17.05	8.40	10.83	12.57	16.67	20.02
T <sub>9</sub> : Salicylic acid (2000 ppm)	6.63	7.87	8.63	13.32	19.40	8.63	10.31	11.50	15.67	24.83
T <sub>10</sub> : Salicylic acid (2500 ppm)	6.47	8.20	9.17	13.70	18.56	8.47	10.62	11.97	16.37	21.96
SEm. ±	0.31	0.30	0.32	0.57	0.54	0.30	0.36	0.41	0.60	1.07
CD at 5%	NS	NS	0.95	1.70	1.87	0.88	1.08	1.23	1.80	3.71
CV %	8.66	6.28	5.48	6.29	5.19	6.31	5.87	5.52	5.71	8.59

**Total sugars**

The data as presented in [Table-2] indicated an increase in total sugars as the storage period increased. Imposition of treatments led to significant differences during the entire storage period. On 1<sup>st</sup> day of storage, salicylic acid 2000 ppm (T<sub>9</sub>)

resulted in the highest total sugar content (8.63%) and was at par with treatment T<sub>6</sub> (8.57%), T<sub>5</sub> (8.53%), T<sub>10</sub> (8.47%), T<sub>8</sub> (8.40%) and T<sub>4</sub> (8.27%), respectively. Silicic acid @ 4ml/l (T<sub>7</sub>) recorded the highest total sugar content on the 4<sup>th</sup> (11.14%), 8<sup>th</sup> (14.67%) and 12<sup>th</sup> (20.17%) day of storage. For all these intervals, it

was at par with silicic acid @ 2 ml/l, silicic acid @ 3 ml/l and potassium silicate @ 3 ml/l. However, on 16<sup>th</sup> day of storage, salicylic acid at 2000 ppm resulted in the highest total sugar content (24.83%) which was at par with the treatment T<sub>10</sub> (21.96%).

### Reducing sugars

The mean data in [Table-3] revealed significant differences among treatments on the 1<sup>st</sup>, 4<sup>th</sup>, 8<sup>th</sup> and 12<sup>th</sup> day of storage. On 1<sup>st</sup> day of storage, the maximum reducing sugars (2.91%) were recorded under potassium silicate @ 3ml/l (T<sub>4</sub>) which was at par with T<sub>2</sub> (2.87%), T<sub>3</sub> (2.77%) and T<sub>6</sub> (2.76%) treatments. On the 4<sup>th</sup>, 8<sup>th</sup> and 12<sup>th</sup> day of storage, silicic acid 4ml/l (T<sub>7</sub>) recorded the maximum reducing sugar (4.81, 4.72 and 4.84%). Treatment T<sub>7</sub> was at par with the remaining two levels of silicic acid (2 and 3 ml/l) for this duration. The reducing sugar content was observed non-significant on 16<sup>th</sup> day of storage. However, salicylic acid 2000 ppm (T<sub>9</sub>) recorded the highest reducing sugars (4.87%) closely followed by T<sub>8</sub> (4.85%) and T<sub>10</sub> (4.82%) treatments.

### Non-reducing sugars

From the data given in [Table-3], it is evident that silicon and salicylic acid had a significant impact on non-reducing sugar content in mango cv. Kesar. The maximum non-reducing sugars (6.30%) were recorded in treatment T<sub>9</sub> (salicylic acid 2000 ppm) on the 1<sup>st</sup> day of storage. This was statistically at par with T<sub>10</sub> (6.10%), T<sub>8</sub> (6.05%), T<sub>5</sub> (5.91%) and T<sub>6</sub> (5.81%) treatments, respectively. On the 4<sup>th</sup> day of storage, the maximum non-reducing sugar content (7.01%) was observed in treatment T<sub>2</sub> (potassium silicate 1ml/l) which was at par with T<sub>4</sub> (6.86%), T<sub>10</sub> (6.74%), T<sub>8</sub> (6.72%), T<sub>5</sub> (6.67%), T<sub>9</sub> (6.53%), T<sub>3</sub> (6.47%), T<sub>7</sub> (6.33%) and T<sub>6</sub> (6.23%) treatments. Foliar spray of silicic acid @ 4 ml/l recorded the highest non-reducing sugar content on 8<sup>th</sup> day (9.95 %) and 12<sup>th</sup> day (15.33%) of storage. This was at par with all three levels of potassium silicate (1, 2 and 3ml/l) and the remaining two levels of silicic acid (2 and 3 ml/l). Treatment T<sub>9</sub> (salicylic acid 2000 ppm) noticed the highest non-reducing sugar content (19.96%) on 16<sup>th</sup> day of storage which was recorded at par with treatment T<sub>10</sub> (17.14%).

**Table-3** Effect of silicon and salicylic acid on reducing sugars and non-reducing sugars in mango cv. Kesar.

Treatments	Reducing sugars (%)					Non-reducing sugars (%)				
	1 <sup>st</sup> day	4 <sup>th</sup> day	8 <sup>th</sup> day	12 <sup>th</sup> day	16 <sup>th</sup> day	1 <sup>st</sup> day	4 <sup>th</sup> day	8 <sup>th</sup> day	12 <sup>th</sup> day	16 <sup>th</sup> day
T <sub>1</sub> : Control	2.16	4.19	4.10	4.66	—	5.27	5.04	7.00	13.90	—
T <sub>2</sub> : Potassium silicate @ 1 ml/l	2.87	4.02	4.13	4.10	4.73	4.77	7.01	8.90	14.30	15.00
T <sub>3</sub> : Potassium silicate @ 2 ml/l	2.77	4.30	4.38	4.39	—	4.96	6.47	8.82	14.91	—
T <sub>4</sub> : Potassium silicate @ 3 ml/l	2.91	4.21	4.57	4.66	—	5.36	6.86	9.23	14.42	—
T <sub>5</sub> : Silicic acid @ 2 ml/l	2.63	4.43	4.49	4.75	—	5.91	6.67	9.88	15.02	—
T <sub>6</sub> : Silicic acid @ 3 ml/l	2.76	4.70	4.66	4.77	—	5.81	6.23	8.87	14.37	—
T <sub>7</sub> : Silicic acid @ 4 ml/l	2.27	4.81	4.72	4.84	—	5.37	6.33	9.95	15.33	—
T <sub>8</sub> : Salicylic acid (1500 ppm)	2.35	4.11	3.87	3.92	4.85	6.05	6.72	8.69	12.75	15.17
T <sub>9</sub> : Salicylic acid (2000 ppm)	2.34	3.78	3.66	3.80	4.87	6.30	6.53	7.84	11.86	19.96
T <sub>10</sub> : Salicylic acid (2500 ppm)	2.37	3.88	3.74	3.82	4.82	6.10	6.74	8.23	12.55	17.14
SEm. ±	0.08	0.15	0.14	0.16	0.12	0.30	0.34	0.43	0.69	0.96
CD at 5%	0.23	0.45	0.42	0.49	NS	0.89	1.02	1.27	2.04	3.32
CV %	5.19	6.22	5.74	6.53	6.90	9.27	9.19	8.49	8.52	9.87

### Titration acidity

Significant differences were noticed in titration acidity during the course of this study [Table-4]. It is apparent from the data that titration acidity showed a constant decline with enhancement of the storage period. The lowest titration acidity was recorded in treatment T<sub>7</sub> (silicic acid 4ml/l), i.e. 0.347, 0.337, 0.257 and 0.200% on

1<sup>st</sup>, 4<sup>th</sup>, 8<sup>th</sup> and 12<sup>th</sup> day of storage. Treatment T<sub>7</sub> was at par with potassium silicate @ 3 ml/l and the rest of the silicic acid treatments (2 and 3 ml/l) for this duration. While, on the 16<sup>th</sup> day of storage, the lowest titration acidity (0.193%) was noticed in salicylic acid 2000 ppm treatment which was at par with salicylic acid at 1500 and 2500 ppm.

**Table-4** Effect of silicon and salicylic acid on titration acidity and ascorbic acid content in mango cv. Kesar.

Treatments	Titration acidity (%)					Ascorbic acid content (mg/100g pulp)				
	1 <sup>st</sup> day	4 <sup>th</sup> day	8 <sup>th</sup> day	12 <sup>th</sup> day	16 <sup>th</sup> day	1 <sup>st</sup> day	4 <sup>th</sup> day	8 <sup>th</sup> day	12 <sup>th</sup> day	16 <sup>th</sup> day
T <sub>1</sub> : Control	0.454	0.403	0.367	0.310	—	15.20	14.70	14.04	11.87	—
T <sub>2</sub> : Potassium silicate @ 1 ml/l	0.403	0.387	0.317	0.286	0.243	16.40	15.90	15.20	13.70	12.43
T <sub>3</sub> : Potassium silicate @ 2 ml/l	0.420	0.397	0.307	0.252	—	16.31	15.81	15.14	13.75	—
T <sub>4</sub> : Potassium silicate @ 3 ml/l	0.367	0.360	0.297	0.224	—	16.11	15.61	14.94	13.64	—
T <sub>5</sub> : Silicic acid @ 2 ml/l	0.360	0.353	0.270	0.223	—	16.40	15.90	15.23	13.68	—
T <sub>6</sub> : Silicic acid @ 3 ml/l	0.390	0.377	0.297	0.228	—	16.10	15.60	14.93	13.64	—
T <sub>7</sub> : Silicic acid @ 4 ml/l	0.347	0.337	0.257	0.200	—	16.53	16.03	15.37	13.88	—
T <sub>8</sub> : Salicylic acid (1500 ppm)	0.410	0.373	0.360	0.257	0.217	16.62	16.12	15.46	13.89	13.16
T <sub>9</sub> : Salicylic acid (2000 ppm)	0.403	0.393	0.323	0.250	0.193	17.23	16.73	15.90	14.03	13.43
T <sub>10</sub> : Salicylic acid (2500 ppm)	0.413	0.390	0.337	0.260	0.203	16.67	16.17	15.50	13.97	13.27
SEm. ±	0.014	0.012	0.014	0.012	0.009	0.49	0.49	0.53	0.67	0.73
CD at 5%	0.043	0.037	0.041	0.036	0.034	NS	NS	NS	NS	NS
CV %	6.32	5.65	7.58	8.42	8.05	5.20	5.37	6.04	8.53	9.70

### Ascorbic acid content

From the data in [Table-4], it is evident that differences in ascorbic acid content in fruits under different treatments were non-significant from the 1<sup>st</sup> day to the 16<sup>th</sup> day of storage. Ascorbic acid content revealed a declining trend with the increase in storage period. The maximum ascorbic acid was recorded on the 1<sup>st</sup> (17.23 mg/100g), 4<sup>th</sup> (16.73 mg/100g), 8<sup>th</sup> (15.90 mg/100g), 12<sup>th</sup> (14.03 mg/100g) and 16<sup>th</sup> (13.43 mg/100g) day of storage under salicylic acid 2000 ppm.

### Total carotenoids

In the present investigation, observations at every interval of storage revealed that there were non-significant differences between treatments with regard to total carotenoids. From the data presented in [Table-5] it is evident that the total carotenoids content revealed an increment trend with an increase in storage life. The maximum total carotenoids were recorded under salicylic acid 2000 ppm on 1<sup>st</sup> (0.79 mg/100g), 4<sup>th</sup> (1.16 mg/100g), 8<sup>th</sup> (1.85 mg/100g), 12<sup>th</sup> (2.46 mg/100g) and 16<sup>th</sup> (2.71 mg/100g) day of storage, respectively.

**Table-5** Effect of silicon and salicylic acid on total carotenoids in mango cv. Kesar.

Treatments	Total carotenoids (mg/100g pulp)				
	1 <sup>st</sup> day	4 <sup>th</sup> day	8 <sup>th</sup> day	12 <sup>th</sup> day	16 <sup>th</sup> day
T <sub>1</sub> : Control	0.67	1.09	1.77	2.38	–
T <sub>2</sub> : Potassium silicate @ 1 ml/l	0.75	1.14	1.80	2.41	2.71
T <sub>3</sub> : Potassium silicate @ 2 ml/l	0.72	1.13	1.79	2.41	–
T <sub>4</sub> : Potassium silicate @ 3 ml/l	0.71	1.11	1.81	2.44	–
T <sub>5</sub> : Silicic acid @ 2 ml/l	0.68	1.10	1.80	2.43	–
T <sub>6</sub> : Silicic acid @ 3 ml/l	0.69	1.11	1.77	2.43	–
T <sub>7</sub> : Silicic acid @ 4 ml/l	0.71	1.13	1.79	2.46	–
T <sub>8</sub> : Salicylic acid (1500 ppm)	0.77	1.14	1.84	2.43	2.70
T <sub>9</sub> : Salicylic acid (2000 ppm)	0.79	1.16	1.85	2.46	2.71
T <sub>10</sub> : Salicylic acid (2500 ppm)	0.78	1.13	1.82	2.44	2.71
SEm. ±	0.03	0.03	0.05	0.07	0.08
CD at 5%	NS	NS	NS	NS	NS
CV %	6.61	5.10	5.02	5.07	5.13

There was a significant influence of silicon and salicylic acid on quality attributes in mango cv. 'Kesar'. Between the three different levels of salicylic acid, foliar spray of 2000 ppm was found to be the most effective and resulted in significantly the highest TSS (%), total sugar (%), reducing sugar (%), non-reducing sugars (%) and minimum titrable acidity (%) [Table-1]. While, amongst different silicon sources, foliar spray of silicic acid @4ml/l proved best and resulted in the maximum TSS (%), total sugar (%), reducing sugar (%), non-reducing sugars (%) and minimum titrable acidity (%) during the entire storage period [Table-1].

The promotive effect of salicylic acid on improving the biosynthesis and translocation of plant pigment and sugar [15] could have resulted into enhancement of fruit quality. Increased photosynthetic activity due to application of salicylic acid was also observed by Singh et al. [22] in mango leaves. The sprays of salicylic acid regulate the carbohydrate metabolism in both source and sink tissue of plants. The hydrolysis of sucrose by invertase regulates the levels of some plant hormones like Indole-3-acetic acid, salicylic acid and jasmonic acid [23]. This information confirms the relationship between salicylic acid and invertase activity. Thus, the accumulation of reducing sugar might be due to increased translocation of more photosynthetic assimilates to the fruits and breakdown of starch during ripening. Moreover, delayed increase of total soluble solids in salicylic acid treated fruits might be due to slower ripening in such fruits, caused by inhibition of ethylene biosynthesis. A delayed increase in TSS of salicylic acid treated fruits was reported in mango [24].

The findings of Singh et al. [22], Ngullie et al. [18] and Reddy and Sharma [19] in mango, Srivastava and Dwivedi [3] in banana, Shaaban et al. [5] in apple and Vatanparast et al. [14] in pomegranate are in agreement with the present investigation.

The beneficial effects of silicon on protecting the plants from unfavorable effects of environment during maturity might have improved fruit quality [25]. Moreover, silicon and potassium may have stimulated the synthesis of more sugars in the fruit which helped in increasing total soluble solids. The decrease in acidity might be due to an increase in total soluble solids.

The promoting effect of silicon on fruit quality was emphasized by Ahmed et al. [6], Abd El-Rahman [26] in mango and Ahmed et al. [27] in pomegranate.

### Conclusion

Based on this study, it can be summarized that salicylic acid at 2000 ppm was beneficial for improving fruit quality, decreasing physiological loss in weight and enhancing shelf life of mango cv. Kesar when sprayed at the pea and marble stage of fruit development under South Gujarat conditions.

### Application of Research

In the Western part of the country, Kesar is a very popular and commercially grown variety of mango. South Gujarat is a major producer of mango cv. Kesar with access to large quality conscious markets like Surat, Vadodara, Nashik and Mumbai. Prolonged shelf life and improved quality under foliar application of

salicylic acid at 2000 ppm would help the farmers get a better price for their produce.

**Research Category:** Shelf life of mango fruits

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### Abbreviations

RHRS	: Regional Horticultural Research Station
TSS	: Total Soluble Solids
PLW	: Physiological Loss in Weight
MT	: Metric Tonnes
RBD	: Randomized Block Design
CFB	: Corrugated Fibre Board
OPSTAT	: Statistical Package for Agricultural Scientists
SAR	: Systematic Acquired Resistance

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