

Original Research Article

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## Studies on Effect of Pre Harvest Treatments for Extending the Post-Harvest Life of Mango cv. Kesar

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### ABSTRACT

Mango (*Mangifera indica* L.) is one of the most luscious fruit of world, which occupies a prime position in the international fruit processing industry of the world. It is one of the most choicest and popular fruit among the people and designated as the 'king of fruits' (Sawke *et al.*, 15). 7 years old mango cv. Kesar garden planted at a spacing of 7.5 m x 7.5 m was selected for the experiment. Spraying was carried out once with Taiwan sprayer at 30 days before harvest of fruits. Initial fruit weight (g), fruit weight at 5, 10 and 15 days after harvest (DAH) was found to be non-significant among various treatments. Physiological loss of weight was significantly low in 2% K<sub>2</sub>SO<sub>4</sub> at 5 (3.97%), 10 (11.11%) and 15 (16.15%) DAH. 4% CaCl<sub>2</sub>.6H<sub>2</sub>O spray recorded lowest anthracnose infestation of 9.87% at 10 DAH, 2% CaCl<sub>2</sub>.6H<sub>2</sub>O and 2% K<sub>2</sub>SO<sub>4</sub> sprays recorded lowest anthracnose infestation of 10.08% at 15 DAH and 2% CaCl<sub>2</sub>.6H<sub>2</sub>O recorded lowest anthracnose infestation of 10.23% at 20 DAH. In terms of qualitative characters, significantly highest total soluble sugars (°B) of 21.27, total sugars percentage of 15.32, reducing sugars percentage of 3.96 and non-reducing sugars percentage of 11.36 was recorded in 2% K<sub>2</sub>SO<sub>4</sub> spray. Significantly low titrable acidity percentage of 0.25% and significantly high ascorbic acid content of 35.55 mg/100 g was recorded in 2% K<sub>2</sub>SO<sub>4</sub> spray.

#### Keywords

Mango, boron, calcium chloride, calcium nitrate, potassium sulphate, shelf life, quality, Days after harvest (DAH)

#### Article Info

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### Introduction

The mango (*Mangifera indica* L) is a juicy stone fruit belonging to the family Anacardiaceae and is an important fruit crop of India, as well as tropical and sub-tropical countries of the world. Mango is a national fruit of India. Besides, its excellent flavour, delicious taste, delicate fragrance and attractive colour, it is known as 'King of fruits'. It is considered to be a good source of β-Carotene and vitamin-A, vitamin-B complex, vitamin-C, nutritive minerals,

digestible sugars and trace elements (Mane *et al.*, 2016). Post-harvest losses vary from 17 to 36 per cent in mango. These losses occur at the farm level (harvesting), grading, transport, storage and marketing (Krishnamurthy and Rao, 2001). The rapid changes that occur after harvest soften the fruit which gives away easy entry for pathogens causing diseases especially anthracnose resulting in heavy post-harvest losses which accounts for 37-75 % of total production. Appropriate chemical treatments reduce the post-harvest losses to some extent. Mango cv. Kesar is famous for

its excellent quality and pleasant flavour. It is one of the leading commercial mango cultivar of India. It is usually preferred for indigenous market but now a days getting place in export market also. It is high yielder, regular bearer, having good consumer acceptance because of its attractive shape, size, colour of pulp and good keeping quality (Mane *et al.*, 2016). So the present study was taken up to study the effect of certain pre harvest treatments on extending the post-harvest life of mango cv. Kesar under Nuzvid conditions.

### Materials and Methods

The present experiment was conducted at Mango Research Station, Nuzvid, Andhra Pradesh for three years on a commercial mango cv Kesar. The selected trees were uniform in size and of 7 years age.

The experiment involved pre-harvest spray of different chemicals which includes *i.e.*, 2%  $\text{CaCl}_2 \cdot 6\text{H}_2\text{O}$ , 4%  $\text{CaCl}_2 \cdot 6\text{H}_2\text{O}$ , 2%  $\text{Ca}(\text{NO}_3)_2$ , 4%  $\text{Ca}(\text{NO}_3)_2$ , 1%  $\text{K}_2\text{SO}_4$ , 2%  $\text{K}_2\text{SO}_4$ , 2% Borax and 3% Borax which were applied as foliar spray. Spraying was carried out once with Taiwan sprayer at 30 days before harvest of fruits. Recommended package of practices schedule for mango has been followed. Data to be collected include initial fruit weight (g), weight (g) of fruit at 5 DAH, weight of fruit (g) at 10 DAH, weight of fruit (g) at 15 DAH, physiological loss of weight (%) (5, 10, 15 DAH), anthracnose infestation (%) 10, 15 and 20 DAH, TSS ( $^\circ\text{Brix}$ ), titrable acidity (%), total sugars (%), reducing sugars (%), non-reducing sugars (%) and ascorbic acid (mg/100g). Pooled statistical analysis was carried out using ANOVA.

### Results and Discussion

Pooled data analysis from table 1 shows that maximum initial fruit weight was 227.78g in 3% borax spray treatment and minimum initial

fruit weight of 209.54g was recorded in 2%  $\text{Ca}(\text{NO}_3)_2$  treatment and the result was in coincidence with the findings of Dutta (2004) who identified appreciable improvement in fruit weight by borax application in mango cv. Himsagar. The increase in fruit weight with the sprays of borax was might be due to the involvement in hormonal metabolism, increased cell division and expansion of cell. Boron is also known to stimulate rapid mobilization of water and sugar in the fruit (Chauhan *et al.*, 2014). Boron facilitated sugar transport within the plant and it was also reported that borate react with sugar to form a sugar-borate complex (Gauch and Dugger, 1953).

Maximum initial fruit weight at 5 DAH was 216.38g in 2%  $\text{K}_2\text{SO}_4$  treatment and minimum initial fruit weight of 185.98g was recorded in control. Maximum initial fruit weight at 10 DAH was 200.35g in 2%  $\text{K}_2\text{SO}_4$  treatment and minimum initial fruit weight of 172.69g was recorded in control. Maximum initial fruit weight at 15 DAH was 188.75g in 2%  $\text{K}_2\text{SO}_4$  treatment and minimum initial fruit weight of 161.96g was recorded in control similarly Jakhar and Pathak (2014) observed that the spray of 2%  $\text{CaCl}_2$  and 1%  $\text{K}_2\text{SO}_4$  combined with bagging was found superior to increase the quality of fruits in respect of fruit weight, TSS, ascorbic acid, sugars,  $\beta$ -carotene content and TSS: acid ratio and decrease the total acidity with minimum black spotted fruits per cent and highest organoleptic quality among all treatments in both the seasons.

Minimum physiological loss of weight (PLW %) percentage of 3.97, 11.11 and 16.15 was recorded in 2%  $\text{K}_2\text{SO}_4$  treatment at 5, 10 and 15 DAH similarly Dutta *et al.*, 2011 observed that mango trees receiving foliar spray of  $\text{K}_2\text{SO}_4$  (1% concentration) had a significant reduction in PLW and recorded a maximum (8 days) shelf life at ambient room temperature as compared to the other treatments.

**Table.1** Effect of pre harvest treatments for extending the post-harvest life of mango cv. Kesar 2012-15

Treatment	Initial Fruit Wt (g)	Fruit Wt 5 DAH (g)	Fruit Wt 10 DAH (g)	Fruit Wt 15 DAH (g)	PLW (%) 5 DAH	PLW (%) 10 DAH	PLW (%) 15 DAH	Anthraco- noses Infestation (%) 10 DAH	Anthraco- noses Infestation (%) 15 DAH	Anthraco- noses Infestation (%) 20 DAH
2% CaCl <sub>2</sub> .6H <sub>2</sub> O	214.87	201.83	188.91	174.28	6.05	12.07	18.90	9.99	10.08	<b>10.23</b>
4% CaCl <sub>2</sub> .6H <sub>2</sub> O	220.53	207.66	195.13	180.44	5.90	11.61	18.28	9.87	10.15	<b>10.34</b>
2% Ca(NO <sub>3</sub> ) <sub>2</sub>	209.54	189.72	176.57	164.72	9.49	15.68	21.42	10.29	10.68	<b>10.80</b>
4% Ca(NO <sub>3</sub> ) <sub>2</sub>	215.03	192.60	178.94	164.52	10.48	16.87	23.45	10.28	10.44	<b>10.56</b>
1% K <sub>2</sub> SO <sub>4</sub>	217.21	207.36	192.71	181.58	4.58	11.36	16.34	10.12	10.39	<b>10.53</b>
2% K <sub>2</sub> SO <sub>4</sub>	225.32	216.38	200.35	188.75	3.97	11.11	16.15	9.94	10.08	<b>10.32</b>
2% Borax	221.94	204.23	191.27	178.17	7.99	13.83	19.76	10.46	10.60	<b>10.93</b>
3% Borax	227.78	207.54	184.40	183.23	8.95	14.70	20.54	10.79	10.86	<b>11.05</b>
Control	216.89	185.98	172.69	161.96	14.45	20.61	25.53	11.07	11.25	<b>11.41</b>
SEM ±	3.52	3.87	3.55	11.35	0.15	0.09	0.13	0.06	0.04	<b>0.05</b>
CD	NS	NS	NS	NS	0.44	0.26	0.39	0.17	0.13	<b>0.14</b>
CV (%)	<b>4.83</b>	<b>5.77</b>	<b>5.70</b>	<b>20.20</b>	<b>5.50</b>	<b>1.81</b>	<b>1.94</b>	<b>1.63</b>	<b>1.28</b>	<b>1.27</b>

**Table.2** Effect of pre harvest treatments for extending the post-harvest life of mango cv. Kesar 2012-15

Treatment	TSS (°B)	Total Sugars (%)	Reducing Sugars (%)	Non Reducing Sugars (%)	Titration Acidity (%)	Ascorbic Acid (mg / 100 g)
2% CaCl <sub>2</sub> .6H <sub>2</sub> O	19.50	13.47	3.11	10.36	0.29	<b>27.22</b>
4% CaCl <sub>2</sub> .6H <sub>2</sub> O	20.35	13.74	3.45	10.29	0.26	<b>24.89</b>
2% Ca(NO <sub>3</sub> ) <sub>2</sub>	19.13	12.73	2.55	10.17	0.36	<b>22.22</b>
4% Ca(NO <sub>3</sub> ) <sub>2</sub>	18.13	13.60	3.26	10.34	0.35	<b>23.89</b>
1% K <sub>2</sub> SO <sub>4</sub>	20.52	14.81	3.75	11.05	0.26	<b>33.33</b>
2% K <sub>2</sub> SO <sub>4</sub>	21.27	15.32	3.96	11.36	0.25	<b>35.55</b>
2% Borax	19.73	13.49	3.12	10.37	0.29	<b>28.33</b>
3% Borax	18.93	12.40	2.41	9.98	0.38	<b>23.33</b>
Control	18.49	11.08	2.16	8.91	0.42	<b>20.55</b>
SEm ±	0.10	0.10	0.03	0.10	0.00	<b>1.25</b>
CD	0.29	0.31	0.08	0.29	0.01	<b>3.76</b>
CV (%)	<b>1.47</b>	<b>2.31</b>	<b>2.71</b>	<b>2.82</b>	<b>3.77</b>	<b>14.14</b>

This might be due to the fact that  $K_2SO_4$  contains considerably more  $SO_4-S$  than the other sources. This study suggests the added advantage of using  $K_2SO_4$  as a source of K to improve fruit quality and shelf life of mango. Maximum PLW percentage of 14.45, 20.61 and 25.53 was recorded in control at 5, 10, 15 DAH respectively and similar findings were recorded by Jakhar and Pathak (2016) in mango cv. Amrapali pre-harvest treatment of 2%  $CaCl_2$ +1%  $K_2SO_4$ +bagging was found superior to improve the quality of fruits in respect of highest fruits weight, firmness, TSS, ascorbic acid, total sugars, and  $\beta$ -carotene content with minimum black spotted fruits per cent and maintained it throughout the storage period upto 18 days. Fruits treated with 2%  $CaCl_2$ +1%  $K_2SO_4$ +bagging showed shelf life up to 12 days with lowest weight loss and highest organoleptic quality as against 6 days of untreated fruits (control).

At 10 DAH minimum anthracnose infestation percentage of 9.87 was recorded in 4%  $CaCl_2.6H_2O$  treatment and maximum anthracnose infestation percentage of 11.07 was recorded in control. At 15 DAH minimum anthracnose infestation percentage of 10.08 was recorded in 2%  $CaCl_2.6H_2O$  and 2%  $K_2SO_4$  treatments and maximum anthracnose infestation percentage of 11.25 was recorded in control. At 20 DAH minimum anthracnose infestation percentage of 10.23 was recorded in 2%  $CaCl_2.6H_2O$  treatment and maximum anthracnose infestation percentage of 11.41 was recorded in control. The result was in correlation with Singh *et al.*, 1993 who observed that dip in 4-6%  $CaCl_2$  can increase the shelf life of some cultivars as  $CaCl_2$  treatment results in low ethylene production, low respiration and reduced storage decay.

Pooled data analysis from table 2 shows that maximum TSS ( $^{\circ}B$ ) of 21.27 was recorded in 2%  $K_2SO_4$  treatment and minimum TSS ( $^{\circ}B$ )

of 18.13 was recorded in 4%  $Ca(NO_3)_2$  treatment. Maximum total sugars (%) of 15.32 was recorded in 2%  $K_2SO_4$  treatment and minimum total sugars (%) of 11.08 was recorded in control. Maximum reducing sugars (%) of 3.96 was recorded in 2%  $K_2SO_4$  treatment and minimum reducing sugars (%) of 2.16 was recorded in control. Maximum non reducing sugars (%) of 11.36 was recorded in 2%  $K_2SO_4$  treatment and minimum non reducing sugars (%) of 8.91 was recorded in control. Minimum titrable acidity (%) of 0.25 was recorded in 2%  $K_2SO_4$  treatment and maximum titrable acidity (%) of 0.42 was recorded in control. Maximum ascorbic acid (mg/100 g) of 35.55 was recorded in 2%  $K_2SO_4$  treatment and minimum ascorbic acid (mg/100 g) of 20.55 was recorded in control. Storage methods and post-harvest treatments to mangoes affect colour, ripening level, TSS, acidity and reduce the decay level and increase the shelf life, which in turn affect the market acceptability (Jha *et al.*, 2010).

In terms of qualitative characters, significantly highest total soluble sugars ( $^{\circ}B$ ) of 21.27, total sugars percentage of 15.32, reducing sugars percentage of 3.96 and non-reducing sugars percentage of 11.36 was recorded in 2%  $K_2SO_4$  spray the result was similar to the findings of Dutta *et al.*, 2011 who observed that the application of  $K_2SO_4$  significantly increased the total soluble solids, total sugar and  $\beta$ -carotene content of fruits over KCl and  $KNO_3$  treated trees. Higher fruit quality, especially higher sugar content can be explained by the role of K in carbohydrate synthesis, breakdown and translocation and synthesis of protein and neutralization of physiologically important organic acids.

Marcio A. Carneiro *et al.*, 2017 observed higher efficiency with respect to the production per plant and yield of mango, in comparison to the fertilization with potassium

chloride, and the dose of 174.24 g per plant of potassium sulfate is recommended for a fruit yield of 23.1 t/ha under the studied conditions with fertilization of potassium sulfate. Significantly low titrable acidity percentage of 0.25% and significantly high ascorbic acid content of 35.55 mg/100 g was recorded in 2% K<sub>2</sub>SO<sub>4</sub> spray the result is in coincidence with barbade and kulkarni (2012) who reported significantly maximum TSS (12.91 °B), total sugars (11.54 %) and minimum acidity (0.44 %) was recorded in T4 (Mulching + K<sub>2</sub>SO<sub>4</sub> 1 %) at harvest. Similarly at edible maturity also significant maximum TSS (19.54 °B), total sugars (16.52 %) and minimum acidity (0.20 %) was recorded in T4 (Mulching + K<sub>2</sub>SO<sub>4</sub> 1 %) in mango cv. Kesar. Similar study by Thirupathi and Ghosh (2015) concluded that Bassein Seedless had highest fruit yield and Ruby had good quality fruits of Pomegranate (*Punica granatum* L.) by foliar application of water soluble fertilizers KNO<sub>3</sub> and K<sub>2</sub>SO<sub>4</sub> among seven cultivars grown in laterite soils of West Bengal. In general, all the 7-cultivars responded well in respect to fruit yield, fruit size and taste (TSS/acid ratio), to foliar feeding of nutrients as compared to un-sprayed (control).

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