Original Research Article

"Interaction Effect of Mango Varieties and Chemical Spray Applications on Post-Harvest Quality Parameters"

ABSTRACT

The present experiment was conducted during the years of 2021 and 2023 at the Regional Horticultural Research Station, ASPEE College of Horticulture, Navsari Agricultural University, Navsari, with the objective to know the impact of chemical spray application on post-harvest parameters of mango. Quality parameters TSS (^{o}Brix) was recorded highest in Variety V_2 (Sonpari) and variety V_3 (Amrapali) recorded highest non reducing sugars (%), total sugars (%). However, variety V_1 (Kesar) recorded highest ascorbic acid (mg/100g) and reducing sugars (%).Quality parameters like TSS (^{0} Brix) and lowest titratable acidity (%) were recorded with chemical C_3 (Novel 1% + $ZnSO_4$ 0.25 % + Boron 0.1 %). Reducing sugars (%), non-reducing sugars (%), total sugars (%) and ascorbic content were recorded significantly highest with chemical treatment C 1 (NAA 20 mg/l + $ZnSO_4$ 0.25 % + Boron 0.1 %). Quality parameters like TSS (^{o} Brix) was recorded significantly highest with V_2 C_2 (Sonpari + GA_3 30 mg/l + $ZnSO_4$ 0.25 % + Boron 0.1%). However, significantly highest ascorbic acid (mg/100g) and reducing sugars (%) were recorded with V_1C_1 (Kesar + NAA 20 mg/l + $ZnSO_4$ 0.25 % + Boron 0.1 %) and significantly highest non reducing sugars (%) and total sugars (%) were recorded with treatment combination V_3C_3 (Amrapali + Novel 1 % + $ZnSO_4$ 0.25 % + Boron 0.1 %).

INTRODUCTION

Mango belongs to the genus *Mangifera* of the family Anacardiaceae and is widely regarded as the 'King of Fruits' in the Indian sub-continent (Tharanatahn *et al.,* 2006). Mango has become naturalized and adapted across the tropics and sub-tropics. Today, mangoes are recognized and consumed throughout the world and are regarded as one of the most popular and esteemed tropical fruits. The genus *Mangifera* originated in tropical Asia, with maximum number of species found in

Borneo, Java, Sumatra and the Malay Peninsula. The most-cultivated *Mangifera* species, *M. indica*, has its origin in India and Myanmar (Bally 2006). When ripe, this delicious dessert fruit is particularly high in vitamin A.

Several factors influence the yield and quality of mangoes, including total soluble solids (TSS), acidity, sugar content, ascorbic acid levels, pulp percentage, and shelf life. These attributes are significantly affected by various pre-harvest practices, among which the application of plant growth regulators plays a crucial role. However, precise information regarding the specific plant growth regulators and their optimal concentrations remains limited. Considering these challenges, it is essential to evaluate the impact of pre-harvest applications of plant growth regulators and chemicals on the quality of Kesar, Sonpari and Amrapali mango (*Mangifera indica* L.)

MATERIALS AND METHODS

The experiment was carried out at Regional Horticultural Research Station, ASPEE College of Horticulture, Navsari Agricultural University, Navsari during the year 2020-21 and 2022-23. The experiment was conducted in Randomized Block Design with factorial concept which comprised of two factors; first factor consisted of three varieties V_1- Kesar, V_2 – Sonpari and V_3 – Amrapali and the second factor consisted of Chemicals *viz.,* C_1- NAA 20 mg/l + $ZnSO_4$ 0.3% + Boron 0.1%, C_2 - GA_3 30 mg/l + $ZnSO_4$ 0.3% + Boron 0.1%, C_3 - Novel 1% + $ZnSO_4$ 0.3% + Boron 0.1%, C_4 – Ca $(NO_3)_2$ + $ZnSO_4$ 0.3% + Boron 0.1% and C_5 – Control (No spray).Total Soluble Solids (TSS) of the mango pulp were recorded by using digital hand refractometer (Range of 0 to 32 °Brix). The average value was calculated and expressed in ºBrix. The method described by Ranganna (1986) was adopted for estimation of titratable acidity. The vitamin C *i.e.* ascorbic acid content was determined by Dye method as detailed by Ranganna (1986). Lane and Eynon (1923) titration method described by Ranganna (1986) was taken on for the estimation of reducing sugars. For total sugars estimation, the filtrate obtained in the above estimation was used. Non-reducing sugar percentage was calculated by subtracting the reducing sugars (%) from the total sugars (%).

3. RESULTS AND DISCUSSION

3.1 Total Soluble Solids (TSS)

The Total Soluble Solids (TSS) content exhibited significant variation across different treatments and mango varieties. Among the varieties, Sonpari (V_2) recorded the highest TSS value of 20.60° Brix, followed closely by Amrapali (V_3) at 20.58° Brix. Among the chemical treatments, the application of GA_3 (30 mg/L) + $ZnSO_4$ (0.25%) + Boron (0.1%) (C_2) resulted in the highest TSS content of 19.66° Brix (Table.1). The interaction between variety and treatment, V_2C_2 (Sonpari + GA_3 (30 mg/L) + $ZnSO_4$ (0.25%) + Boron (0.1%)), exhibited the maximum TSS value (21.61^0 Brix) (Table.1), indicating a significant influence of growth regulators and micronutrients on sugar accumulation and fruit quality. Increase in TSS might be due to respirational demand and adequate supply of nutrients, synthesis of invertase and starch splitting enzymes (Ram and Prasad, 1988). Similar results were obtained in relation to fruit quality by Anon. (2014) in banana and Anon. (2013) in papaya. Higher TSS may also be due to the increased total sugar content owing to the efficient translocation of available photosynthates to fruit pulp rather than to other parts.

3.2 Titratable Acidity

Titratable acidity demonstrated a decreasing trend with the application of growth regulators and micronutrients. Among the varieties, Amrapali (V_3) exhibited the lowest acidity (0.217%), whereas Kesar (V_1) recorded the highest value (0.312%). Among the chemical treatments, NOVEL @ 1% + ZnSO4 (0.25%) + Boron (0.1%) (C_3) resulted in the lowest acidity (0.228%) (Table.1). The interaction effect was most pronounced in V_3C_3 (Amrapali + NOVEL @ 1% + $ZnSO_4$ (0.25%) + Boron (0.1%)), which recorded the lowest titratable acidity (0.175%) (Table.1). These findings suggest that growth regulators and micronutrients effectively modulate the acid-sugar balance, thereby enhancing fruit palatability.

3.3 Ascorbic Acid Content

The ascorbic acid content varied significantly across varieties and treatments. Among the varieties, Kesar (V_1) exhibited the highest ascorbic acid content (40.50 mg/100g). Among the chemical treatments, NAA (20 mg/L) + $ZnSO_4$ (0.25%) + Boron (0.1%) (C_1) resulted in the highest ascorbic acid content (44.64 mg/100g) (Table.1). The interaction effect was most prominent in V_1C_1 (Kesar + NAA (20 mg/L) + $ZnSO_4$ (0.25%) + Boron (0.1%)), where the ascorbic acid content reached 44.04 mg/100g (Table.1). These results highlight the beneficial role of growth regulators and micronutrients in enhancing the vitamin C content of mango fruits. Higher value of ascorbic acid content in fruits treated with NAA might be due to higher level of sugars in these fruits, which increased the content of ascorbic acid, since ascorbic acid is synthesized from sugar (Singh *et al.,* 2017). Similar results were observed by Sankar *et al.* (2013) in mango. These results are in accordance with findings of Shrivastava and Jain (2006) in mango and Shukla *et al.* (2011) in aonla.

3.4 Reducing Sugars

The reducing sugar content ranged from 4.65% to 5.91% across different treatments. The highest reducing sugar content was observed in Kesar (V_1) under C_1 treatment (5.91%), followed by Amrapali (V_3) under the same treatment (5.73%) (Table.2). Among the varieties, Kesar recorded a reducing sugar content of 5.6% (Table.1). Among the chemical treatments, NAA (20 mg/L) + $ZnSO_4$ (0.25%) + Boron (0.1%) resulted in the highest reducing sugar content (5.69%) (Table.1).

3.5 Non-Reducing Sugars

Non-reducing sugars varied across treatments, with Amrapali (V_3) exhibiting the highest non-reducing sugar content (12.94%) under C_1 treatment(Table.2). Among the varieties, Amrapali recorded the highest non-reducing sugar content (11%). Among the chemical treatments, NAA (20 mg/L) + $ZnSO_4$ (0.25%) + Boron (0.1%) resulted in the highest non-reducing sugar content (9.81%) (Table.1). These findings suggest that micronutrient supplementation and growth regulator applications play a crucial role in sugar metabolism, enhancing fruit sweetness and consumer acceptability.

3.6 Total Sugars

The total sugar content was highest in Amrapali (V_3) treated with NAA (20 mg/L) + $ZnSO_4$ (0.25%) + Boron (0.1%) (C_1), reaching 18.67%, followed by Amrapali under NOVEL (1%) + $ZnSO_4$ (0.25%) + Boron (0.1%) (C_3) at 16.21% (Table.2). Among the varieties, Amrapali recorded the highest total sugar content (16.2%) (Table.1). Among the chemical treatments, NAA (20 mg/L) + $ZnSO_4$ (0.25%) + Boron (0.1%) exhibited the highest total sugar content (15.51%). The lowest total sugar content was recorded in Sonpari (V_2) under control conditions (11.78%). These findings indicate that growth regulators and micronutrient applications significantly enhance sugar accumulation, which is vital for improving fruit quality, consumer preference, and market demand. Among the chemical treatments, NAA (20 mg/L) + $ZnSO_4$ (0.25%) + Boron (0.1%) exhibited the highest reducing sugar content (5.9%). The application of growth regulators, particularly NAA and GA_3, significantly enhanced reducing sugar levels across all varieties. This improvement suggests a positive influence on sweetness development, fruit quality, and commercial value. This might be due to synthesis of auxin in plants, which increase the physiological activities and in turn helps in increasing sugar contents. The results are also in accordance with the findings of Sharma *et al.* (1990), Patel (1991), Patel (1992), Haidry *et al.* (1997), Shinde *et al.* (2006) in mango, Bhatt *et al.* (2012) and Singh *et al.* (2013) in mango and Venu *et al.* (2014) in acid lime.

Treatments	Post Harvest Parameters					
	TSS (^{0} Brix)	Titrable Acidity (%)	Ascorbic acid (mg/100g)	Reducing sugars (%)	Non reducing sugars (%)	Total sugars (%)
V: 1	16.59	0.312	40.5	5.6	7.98	13.59
V: 2	20.60	0.252	32.91	4.95	7.58	12.52

V: 3	20.58	0.217	37.3	5.21	11	16.22
SEm±	**0.09**	**0.001**	**0.15**	**0.02**	**0.04**	**0.06**
CD@5%	**0.26**	**0.003**	**0.43**	**0.06**	**0.12**	**0.18**
C: 1	19.14	0.241	39.66	5.69	9.81	15.51
C: 2	19.69	0.249	36.64	5.29	8.56	13.85
C: 3	19.44	0.228	37.31	5.32	8.81	14.14
C: 4	19.23	0.259	37.5	5.11	8.99	14.1
C: 5	18.63	0.328	33.41	4.87	8.06	12.94
SEm±	**0.12**	**0.001**	**0.19**	**0.03**	**0.05**	**0.08**
CD@5%	**0.34**	**0.004**	**0.56**	**0.08**	**0.16**	**0.23**
Interaction (V X C)						
SEm±	**0.21**	**0.21**	**0.34**	**0.05**	**0.09**	**0.14**
CD@5%	**0.59**	**0.60**	**0.97**	**0.15**	**0.28**	**0.41**
Interaction (V X C X Y)						
SEm±	0.13	0.004	0.48	0.07	0.13	0.2
CD@5%	NS	NS	NS	NS	NS	NS

Table 1. Effect of varieties and chemicals on post-harvest parameters in mango (Pooled data of 2021 and 2023)

Note: $\mathbf{V_1}$ – Kesar, $\mathbf{V_2}$ – Sonpari, $\mathbf{V_3}$ – Amrapali, $\mathbf{C_1}$ – NAA (20 mg/l) + $ZNSO_4$ (0.25%) + Boron (0.1%), $\mathbf{C_2}$ – GA3 (30 mg/l) + $ZNSO_4$ (0.25%) + Boron (0.1%), $\mathbf{C_3}$ – NOVEL (1%) + $ZNSO_4$ (0.25%) + Boron (0.1%), $\mathbf{C_4}$ – Ca $(NO_3)_2$(0.3%) + $ZNSO_4$ (0.25%) + Boron (0.1%) and $\mathbf{C_5}$ - Control (No spray).

Table 2. Interaction effect of Varieties and Chemicals on post-harvest parameters of Mango (Pooled 2021 and 2023)

Treatment combinations	Post-harvest parameters					
	TSS (^{0}Brix)	Titrable acidity (%)	Ascorbic acid (mg/100g)	Reducing sugars (%)	Non reducing sugars (%)	Total sugars (%)
$\mathbf{V_1C_1}$	16.38	0.288	44.04	5.91	8.59	14.5
$\mathbf{V_1C_2}$	16	0.318	41.5	5.85	7.92	13.78
$\mathbf{V_1C_3}$	17.55	0.287	40.64	5.75	7.94	13.69
$\mathbf{V_1C_4}$	16.58	0.285	39.68	5.27	7.81	13.09
$\mathbf{V_1C_5}$	15.98	0.394	36.64	5.25	7.62	12.87
$\mathbf{V_2C_1}$	20.71	0.266	34.28	5.44	7.95	13.35
$\mathbf{V_2C_2}$	21.61	0.192	32.83	4.96	7.58	12.54
$\mathbf{V_2C_3}$	20.04	0.193	33.88	4.93	7.57	12.51
$\mathbf{V_2C_4}$	20.94	0.28	33.46	4.76	7.66	12.44
$\mathbf{V_2C_5}$	19.7	0.337	30.11	4.65	7.12	11.78
$\mathbf{V_3C_1}$	20.33	0.207	40.67	5.73	12.94	18.67
$\mathbf{V_3C_2}$	20.72	0.238	35.58	5.05	10.19	15.25
$\mathbf{V_3C_3}$	21.48	0.175	37.4	5.28	10.93	16.21
$\mathbf{V_3C_4}$	20.17	0.218	39.36	5.28	11.48	16.77
$\mathbf{V_3C_5}$	20.21	0.257	33.49	4.72	9.44	14.17
SEm±	**0.21**	**0.002**	**0.34**	**0.05**	**0.09**	**0.14**
CD@5%	**0.59**	**0.007**	**0.97**	**0.15**	**0.28**	**0.41**

4. CONCLUSION

The study demonstrates that the application of growth regulators and micronutrients has a significant impact on the biochemical attributes of mango fruits. The highest TSS was recorded in Sonpari (V_2) under GA_3 (30 mg/L) + $ZnSO_4$ (0.25%) + Boron (0.1%) (C_2), whereas Amrapali (V_3) exhibited the highest total sugars under NAA (20 mg/L) + $ZnSO_4$ (0.25%) + Boron (0.1%) (C_1). Additionally, Kesar (V_1) showed maximum ascorbic acid content when treated with NAA (20 mg/L) + $ZnSO_4$ (0.25%) + Boron (0.1%) (C_1). These results highlight the potential of using growth regulators and micronutrients to enhance fruit sweetness, vitamin C content, and overall quality, thereby improving commercial viability and consumer acceptance of mango varieties.

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