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Influence of Bio-stimulants on the Quality Attributes of Mango (*Mangifera indica* L.) cv. Mallika under Central Dry Zone of Karnataka

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ABSTRACT: Poor quality fruit is one of the major constraint in Mango production. Since, bio-stimulants has a role in improving quality of fruits, a field experiment was carried out in ZAHRS, Hiriyur, during the year 2021-22. The experiment was laid out in RCBD comprising of nine treatments *viz.*, T_1 – control, T_2 - jasmonic acid (100 µM), T_3 - jasmonic acid (150 µM), T_4 - salicylic acid (100 ppm), T_5 - salicylic acid (150 ppm), T_6 - brassinosteroid (0.40 ppm), T_7 - brassinosteroid (0.60 ppm), T_8- triacontanol (7.5 ppm) and T_9 - triacontanol (10.0 ppm) with four replications, sprayed at an interval of 70 and 90 days after anthesis. Among the treatments, T_5 - salicylic acid (150 ppm) recorded maximum TSS (22.86 °B), reducing sugars (6.29%), total sugars (15.72%), sugar-acid ratio (44.62), total carotenoids and flavonoids (5.56 mg/100g and 30.63 mg QE/100 g, respectively), proline content (23.42 µg/g of fw), total antioxidant activity (42.10%), shelf life (14.75 days) and highest score for organoleptic evaluation with minimum titratable acidity (0.35%) and moisture content (76.58%).

Keywords: Mango, Mallika, bio-stimulants, quality attributes.

INTRODUCTION

Mango (*Mangifera indica* L.) belongs to the family Anacardiaceae with chromosome number 2n (4x) = 40 is the choicest, demanding fruit crop of India, which holds a great cultural, socio-economic and religious significance with a long history of cultivation. The 'King of fruit' has a superior nutritional value (Ribeiro *et al*., 2008) with 81.7 g of water, 16 g of carbohydrates, 0.7 g of protein, 0.4 g of fat and 0.1 g of fibre per 100 g of fruit.

Recently, due to changing climate and undesirable biotic and abiotic stresses the quantity and quality of Mango fruits are getting degraded and Indian mangoes are getting reject at international market (Priyaranjan *et al*., 2022). So, it is important to produce good quality fruits. Plant bio-stimulants are a novel class of chemicals, mostly exploited in sustainable fruit production, that attempt to accelerate plant development even after a stressful crisis has elapsed and have physiological effects akin to phytohormones (Kavinmukil *et al*., 2022). They not only enhance nutrition efficiency but also provide resistance against stress condition.

It also appears to have prominent effect on productivity and quality of fruit crop resulting from increased availability of metabolites and assimilates. Further, foliar application will economise the use of chemicals by reducing losses (Hayat *et al*., 2010). There are several studies revealing the beneficiary effects of salicylic acid in improving the quality of Mango *viz.*, Ngullie *et al*. (2014) reported that significantly higher fruit TSS (18.59 °B), reducing sugar (3.95%) and minimum titratable acidity (0.23%) was recorded with the application of salicylic acid (2000 ppm) at flower bud initiation stage of Mango cv. Kesar, Ahmed *et al*. (2015) concluded that salicylic acid at 200 ppm for improved TSS (19.1 and 19.1 %), total sugars (13.9 and 14.2 %), reducing sugars (4.6 and 4.7 %) and vitamin C content (50.1 and 51.2 mg/100g) in Sukkary Mango, application of salicylic acid @ 200 ppm delayed the ripening cum senescence processes and helped in

maintaining post-harvest quality through better retention of soluble solid concentrates (SSC) (27.72 °B), total acidity (0.53%) and ascorbic acid (32.52 mg/100g) in Mango cv. Amrapali opined by Reddy *et al.* (2016). Similarly, Chourasia (2021) reported that minimum physiological loss in weight (11.1%) was observed with use of 100 ppm salicylic acid. In other fruit crops, salicylic acid at 4.0 mM increased the quality in strawberry cv. Festival (Youssef *et al*., 2017), salicylic acid (2 mM) showed superiority by decreasing physiological loss in weight (PLW), rachis browning, fungal decay, berry shattering, titratable acidity and increasing berry firmness, TSS, ascorbic acid, total sugars, reducing sugars, TSS: acid ratio, taste, overall acceptability and shelf life in Grape (Hazarika and Marak 2021).

MATERIALS AND METHODS

The experiment was carried out during 2021-22 in the Zonal Agricultural and Horticultural Research Station (ZAHRS), Babbur farm, Hiriyur taluk of Chitradurga district. The experiment was laid out in Randomized Complete Block Design (RCBD) comprising of nine treatments *viz*., T_1 – control, T_2 - jasmonic acid (100 µM), T_3 - jasmonic acid (150 µM), T_4 - salicylic acid (100 ppm), T_5 - salicylic acid (150 ppm), T_6 - brassinosteroid (0.40 ppm), T_7 - brassinosteroid (0.60 ppm), T_8- triacontanol (7.5 ppm) and T_9 - triacontanol (10.0 ppm) with four replications, sprayed at an interval of 70 and 90 days after anthesis.

RESULTS AND DISCUSSION

The results were tabulated and interpreted in Table 1 and 2 based on the observations recorded in the present research.

Effect of bio-stimulants on quality parameters of mango cv. Mallika

Total soluble solids (TSS). In the present study the TSS is significantly influenced by the application of bio-stimulants. The maximum TSS was found in T_5 - salicylic acid @ 150 ppm (22.86ºB), whereas minimum TSS was recorded in T_1 – control (18.83ºB).

According to Singh *et al*. (2001) total soluble solids might have increased during fruit ripening due to the action of sucrose-phosphate synthase (SPS), a key enzyme in sucrose biosynthesis. Similar findings are reported by Ngullie *et al*. (2014) in mango, Ali *et al*. (2014) in peach Fatemeh *et al*. (2015) and Babak *et al*. (2015) in strawberry.

Titratable acidity. The perusal of data indicated that there is a significant difference among the treatments. The maximum acidity was found in T_1 - control (0.45%). The minimum acidity was found in T_5 - salicylic acid @ 150 ppm (0.35%).

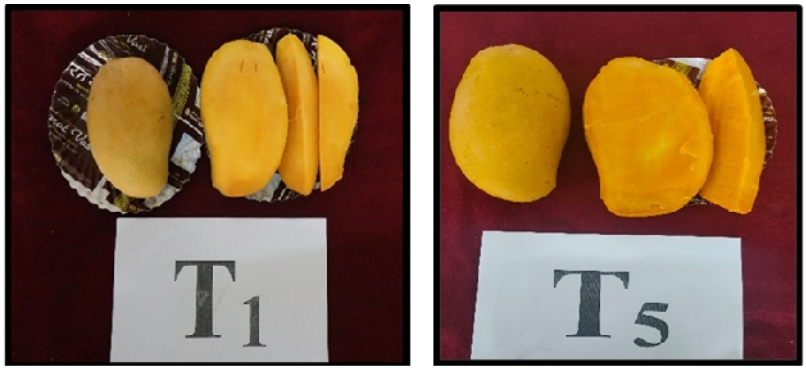
It has been suggested that, titratable acidity decreased due to hydrolysis of organic acids in pyruvate decarboxylation reaction occurring during the ripening process and subsequent accumulation of organic acids, which were oxidised at a slow rate because of decreased respiration.

Table 1: Effect of bio-stimulants on quality parameters of mango cv. Mallika.

Treatment	TSS (ºB)	Titratable acidity (%)	Moisture (%)	Reducing sugars(%)	Total sugars (%)	Sugar-acid ratio	Total carotenoids (mg/100 g)	Total flavonoids (mg QE/100 g)	Total antioxidant activity (%)	Proline content (µg/g of fw)	Shelf life (days)
T_1-Control	18.83	0.45	81.08	4.73	13.89	31.22	4.41	25.48	29.87	18.31	7.75
T_2 – Jasmonic Acid (100µM)	20.22	0.38	79.13	5.83	15.24	40.13	5.29	28.51	38.75	21.80	12.50
T_3- Jasmonic Acid (150 µM)	20.42	0.37	77.53	5.87	15.30	41.08	5.30	29.43	41.01	22.65	13.75
T_4- Salicylic Acid (100ppm)	20.40	0.39	77.63	5.84	15.26	39.21	5.25	28.03	40.31	21.73	13.00
T_5 - Salicylic Acid (150 ppm)	22.86	0.35	76.58	6.29	15.72	44.62	5.56	30.63	42.10	23.42	14.75
T_6- Brassinosteroid (0.40 ppm)	19.06	0.41	80.65	4.77	13.94	33.89	4.51	25.86	30.72	19.95	8.50
T_7- Trassinosteroid (0.60 ppm)	19.78	0.40	79.09	4.98	14.16	35.22	4.69	26.68	34.22	20.19	9.00
T_8- Triacontanol (7.5 ppm)	19.76	0.40	79.14	4.88	14.05	35.12	4.56	26.08	34.02	20.58	9.25
T_9– Triacontanol (10.0 ppm)	20.10	0.39	78.91	5.10	14.37	36.84	4.87	26.36	37.33	20.84	10.00
S.Em ±	**0.55**	**0.01**	**0.58**	**0.05**	**0.09**	**0.74**	**0.07**	**0.38**	**0.98**	**0.55**	**0.36**
C.D. @ 5%	**1.61**	**0.02**	**1.70**	**0.14**	**0.27**	**2.17**	**0.20**	**1.10**	**2.86**	**1.62**	**1.05**

Table 2: Effect of bio-stimulants on organoleptic evaluation of mango cv. Mallika.

Organoleptic evaluation					
Treatments	**Appearance**	**Color**	**Texture**	**Flavour**	**Overall acceptability**
T_1–Control	7.32	7.41	7.54	7.63	6.69
T_2 – Jasmonic Acid (100µM)	8.34	8.45	8.38	8.34	8.36
T_3- Jasmonic Acid (150 µM)	8.54	8.74	8.52	8.61	8.38
T_4-Salicylic Acid (100ppm)	8.21	8.20	8.05	8.03	8.24
T_5 - Salicylic Acid (150 ppm)	8.60	8.92	8.73	8.67	8.45
T_6-Brassinosteroid(0.40 ppm)	7.57	7.66	7.60	7.76	7.74
T_7-Brassinosteroid(0.60 ppm)	7.90	7.95	7.78	7.93	7.83
T_8- Triacontanol (7.5 ppm)	7.71	7.82	7.71	7.87	7.81
T_9 – Triacontanol (10.0 ppm)	7.96	8.12	7.86	7.97	7.93
S.Em ±	**0.07**	**0.09**	**0.16**	**0.18**	**0.08**
C.D. @ 5%	**0.21**	**0.25**	**0.46**	**0.53**	**0.23**



T_1 – Control **T_5 – Salicylic acid @ 150 ppm**

Plate 1. Effect of bio-stimulants on physical appearance and color of mango cv. Mallika.

The findings of Singh *et al*. (2001), Kumar and Reddy (2008), Eman *et al*. (2013), Faissal *et al*. (2014), Ngullie *et al*. (2014), Shivendra and Singh (2015) and Reddy *et al.* (2016) in mango are in conformity.

Moisture. The maximum moisture content was recorded in T_1 - control (81.08%), whereas minimum moisture content was recorded in T_5 -salicylic acid @ 150 ppm (76.58%). There was a significant difference among the treatments.

Lesser the moisture content faster will be the dehydration and lesser will be the water activity. Lesser water activity decreases the microbial growth. Similar findings are found by Shivendra and Singh (2015), Nyangena *et al*. (2019) in mango.

Reducing and total sugars. The results concerning to reducing sugars showed significant difference among the different. The highest reducing sugars was found in T_5 - salicylic acid @ 150 ppm (6.29%) and minimum was recorded in T_1 - control (4.73%).

The total sugars also differed significantly among the treatments. The maximum total sugars was observed in T_5 -salicylic acid @ 150 ppm (15.72%), however the minimum total sugars was recorded in T_1 - control (13.89%).

Increased sugar contents of fruits with salicylic acid treatment might be due to the fact that the salicylic acid regulates the carbohydrate metabolism in both source and sink and also the accumulation of sugars could be due to increased translocation of more photosynthetic assimilates to the fruits and breakdown of starch. The hydrolysis of sucrose by invertase regulates the levels of some plant hormones like indole-3acetic acid, salicylic acid and jasmonic acid. This information confirms the relationship between salicylic acid and invertase activity and are in conformity with the findings of Eman *et al*. (2013), Faissal *et al*. (2014) and Ngullie *et al*. (2014) and Shivendra and Singh (2015) in mango.

Sugar-acid ratio. The bio-stimulants application significantly varied sugar-acid ratio. The maximum sugar-acid ratio was found in T_5 - salicylic acid @ 150 ppm (44.62), however the minimum sugar-acid ratio was recorded in T_1 -control (31.22).

The accumulation and translocation of sugars, that increased the total sugars and corresponding decrease in acidity. Similar results were obtained by Kumar and Reddy (2008), Eman *et al*. (2013), Faissal *et al*. (2014) and Ngullie *et al*. (2014) Shivendra and Singh (2015) in mango.

Total carotenoids. The perusal of data on total carotenoids indicated that, there exists a significant difference among the treatments. The maximum total carotenoids was recorded in T_5 - salicylic acid @ 150

ppm (5.56 mg/100g) and the minimum total carotenoids was found in T_1 - control (4.41 mg/100g).

Carotenoids can be considered as an important factor for protecting organisms against photo-oxidative processes. Direct stimulation of carotenoid biosynthesis by salicylic acid or by indirect biosynthesis of carotenoid after application of salicylic acid (Faissal *et al*., 2014) and our results showed that salicylic acid pre-harvest treatment could have slowed down the degradation of carotenoid during storage. These results are in conformity with Ngullie *et al*. (2014) in mango, Ahmed *et al*. (2015) in grape fruit, Ali *et al*. (2014) in peach, Fatemeh *et al*. (2015) and Babak *et al*. (2015) in strawberry.

Total flavonoids. In the present study the total flavonoids was significantly influenced by the application of bio-stimulants. The maximum total flavonoids was found in T_5 -salicylic acid @ 150 ppm (30.63 mg QE/100g), whereas minimum total flavonoids was recorded in T_1 – control (25.48 mg QE/100g).

Flavonoids are the secondary metabolites and are important nutraceutical elements. There is a change in the permeability of the cell membranes and also in the activity of membrane bound enzymes, which caused the accumulation of toxic intermediates in the cells. This change creates physiological stress in plant cells. Therefore, the levels of phenylalanine ammonia lyase, an enzyme involved in the synthesis of flavonoids considerably increased (Eman *et al*., 2013). Similar findings are noticed by Singh *et al*. (2001), Faissal *et al*. (2014), Shivendra and Singh (2015) in mango, Ahmed *et al*. (2015) in grape fruit.

Total Antioxidant activity. The perusal of data revealed that there exists a significant difference among the treatments. The highest antioxidant activity was recorded in T_5 - salicylic acid @ 150 ppm (42.10%) and the lowest antioxidant activity was found in T_1 - control (29.87%).

Increase in antioxidant activity is mainly due to increase in carotenoids and flavonoids content. High antioxidant activity indicates higher phenolic and ascorbic content. Free radicals and active oxygen species (AOS) are produced during normal cell metabolism and also in response to biotic and abiotic stresses and antioxidants are consumed for scavenging free radicals and AOS. With progress in senescence and increase in metabolic activities, the rate of free radicals and AOS production is increased which precedes the antioxidant systems leading to cell damage and subsequent postharvest losses. Then any factor decreasing cell metabolic activities and contributing in defense systems against different stresses will decrease the rate of free radical production and senescence leading to antioxidant preservation, thereby increasing antioxidant activity. The results are in conformity with the findings of Ahmed (2001), Helaly *et al*. (2018) in mango and Sayyari *et al.* (2011) in pomegranate.

Proline content. It is evident from the perusal of data that, proline content varied significantly among the treatments. The highest proline content was recorded in T_5 - salicylic acid @ 150 ppm (23.42 µg/g of fresh weight), whereas the lowest proline was found in T_1 - control (18.31 µg/g of fresh weight).

Salicylic acid was shown to cause changes in hormonal system associated with transitory parallel accumulation of IAA and ABA led to no detrimental effects which was followed by enhancing expression of genes of dehydrins and accumulation of proline. Salicylic acid increased proline production by decreasing proline oxidase activity, resulting in the promotion of osmotic potential necessary for maintaining crucial physiological processes. Hence, proline proved to have role in tolerating drought/stress condition. Similar findings were noticed by Helaly *et al*. (2018) in mango, Unal *et al.* (2015) in apple, Khoshbakht and Asgharei (2015) in citrus.

Shelf life. The perusal of data indicated that, there exists significant difference among treatments. The highest shelf life was recorded in T_5 - salicylic acid @ 150 ppm (14.75 days) on par with T_3 - jasmonic acid @ 150 µM (13.75 days). The lowest shelf life was recorded in T_1 - control (7.75 days).

Regarding shelf life, the application of salicylic acid increases fruit firmness (Srivastava and Dwivedi 2000) by decreasing the activity of cell wall degrading enzyme like cellulase, polygalacturonase and xylanase. Salicylic acid also interferes with biosynthesis and/ or action of ethylene 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 and pathogen attack (Hayat *et al*., 2010). The findings of Ngullie *et al*. (2014) and Reddy *et al.* (2016) in mango, Srivastava and Dwivedi (2000) in banana, Cao *et al*. (2006) in pear, Babalar *et al*. (2007) in strawberry and Obeed (2011) in grape are in conformity with the present investigation.

Organoleptic evaluation. Application of bio-stimulants had a marked influence on organoleptic evaluation. The highest score for appearance (8.60), color (8.92), texture (8.73), flavour (8.67) and overall acceptability (8.45) were found in T_5 -salicylic acid @ 150 ppm. However, the lowest score was recorded in T_1 - control (7.32, 7.41, 7.54, 7.63 and 6.69, respectively).

Attractive yellow pulp color is probably due to higher carotenoid synthesis in fruits with increased maturity. Taste can be attributed to better accumulation of photosynthates in salicylic acid applied trees (Ahmed *et al*., 2015) which improved fruit quality in terms of TSS, total sugars, reducing sugars, non-reducing sugars and minimized the titratable acidity percentage. Close association of flavour and taste of fruits with TSS and sugars are already well established. There is a distinct possibility that fruits having higher TSS and sugars

which ultimately contribute to better taste of fruits. Similar findings were also observed by Singh *et al*. (2001), Kumar and Reddy (2008), Eman *et al*. (2013), Faissal *et al*. (2014) and Reddy *et al.* (2016) in mango, Babalar *et al*. (2007) in strawberry and Kassem *et al*. (2011) in ber.

CONCLUSION

Based on the above results, it can be concluded that salicylic acid @ 150 µM showed its potentiality in improving quality by recording maximum TSS, reducing non-reducing and total sugars, sugar-acid ratio, total carotenoids and flavonoids, proline, total antioxidant activity, shelf life with minimum acidity and physiological loss in weight in mango cv. Mallika under central dry zone of Karnataka sprayed at an interval of 70 and 90 days after anthesis.

FUTURE SCOPE

Future studies needed to be carried out on combination of different bio-stimulants to enhance yield and quality in different fruit crops.

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Conflict of interest. None.

REFERENCES

Ahmed, M. A. (2001). Studies for Controlling Malformation and Improving Yield and Fruit Quality of Hindy Bisinnara Mangoes by using Active Dry Yeast, Ascorbic Acid and Sulphur. *Minia Journal of Agricultural Research Development, 21*(2), 219–233.

Ahmed, F. F., Mansour, A. E. M. and Merwad, M. A. (2015). Physiological Studies on the Effect of Spraying Salicylic Acid on Fruiting of Sukkary Mango Trees. *International Journal of Chem. Tech. Research*, *8*(4), 2142-2149.

Ahmed, W., Ahmed, S., Ali, L. and Hussan, H. (2015). Effect of Pre-harvest Spray of Salicylic (SA) and Methyl Jasmonate (MeJA) on the Phytochemicals and Physiological Changes during the Storage of Grapefruit cv. Ray Ruby. *International Journal of Biosciences*, *6*(1), 269-282.

Ali, I., Abbasi, N. A. and Hafiz, I. A. (2014). Physiological Response and Quality Attributes of Peach fruit cv. Floridaking as Affected by Different Treatments of Calcium Chloride, Putrescine and Salicylic Acid. *Pakistan Journal of Agricultural Sciences*, *51*(1), 33-39.

Babak, J., Saeid, E. and Katayoon, S. (2015). Growth and Fruit Characteristics of Strawberry cv. Selva as Affected by different application timing of salicylic acid under saline conditions. *International Journal of Fruit Science*, *15*, 339-352.

Babalar, M., Asghari, M., Talaei, A. and Khosroshahi, A. (2007). Effect ofPre- and Postharvest Salicylic Acid Treatment on Ethylene Production, Fungal Decay and Overall Quality of Selva Strawberry Fruit. *Food Chemistry*, *105*, 449–453.

B. Kavinmukil, J. Rajangam, S. Muthuramalingam and K. M. Sellamuthu (2022). Impact of Biostimulants on Floral Induction and Yield Attributing Traits of Pitaya (*Hylocereus undatus* L.). *Biological Forum – An International Journal*, *14*(3), 52-57.

Cao, J., Zeng, K. and Jiang, W. (2006). Enhancement of Post-Harvest Disease Resistance in Ya Li Pear (*Pyrus Bretschneideri*) Fruit by Salicylic Acid Sprays on the Trees during Fruit Growth. *European Journal of Plant Pathology*, *114*(4), 363–370.

Chourasia, B. K. M. H. (2021). Effect of Foliar Application of Nitrogen and Plant Growth Regulators on Bearing, Physico-Chemical Constituents and Shelf-Life of Mango (*Mangifera indica* L.). *Annals of plant and soil research*, *23*(1), 71-76.

Eman, A. A., Abd El-Monem., Ahmed, A. Z. and Ayman, E. S. (2013). Role of Some Postharvest Treatments in Maintaining Mango Fruit Quality During Cold Storage. *Journal of Applied Sciences Research*, *9*(3), 2355-2366.

Faissal, F. A., Mohamed, K. K. and Hamdy, I. M. I. (2014). The Synergistic Effects of Using Plant Extracts and Salicylic Acid on Yield and Fruit Quality of Keitte Mango Trees. *Stem Cell*, *5*(2), 30-39.

Fatemeh, A., Mesbah, B. and Ahmad, A. (2015). The Effect of Salicylic Acid Foliar Spraying on Qualitative Characters of Strawberry Fruit (*Fragaria* × *ananassa* cv. Camarosa). *Iranian Journal of Horticultural Sciences*, *45*(4), 325-334.

Hayat, Q., Hayat, S., Irfan, M. and Ahmad, A. (2010). Effect of Exogenous Salicylic Acid under Changing Environment: A Review. *Environmental and Experimental Botany*, *68*, 14-25.

Hazarika, T. K. and Marak, T. (2021). Salicylic Acid and Oxalic Acid in Enhancing the Quality and Extending the Shelf Life of Grape cv. Thompson Seedless. *Food Science and Technology International*, *1*(1), 1-13.

Helaly, M. N., EL-Sheery, N. I., El-Hoseiny, H., Rastogi, A., Kalaji, H. M. and Zabochnicka-Świątek, M. (2018). Impact of Treated Wastewater and Salicylic Acid on Physiological Performance, Malformation and Yield of Two Mango Cultivars. *Scientia Horticultarae*, *332*, 159-177.

Kassem, H. A., Al-Obeed, R. S., Ahmed, M. A. and Omar, A. K. H. (2011). Productivity, Fruit Quality and Profitability of Jujube Trees Improvement by Pre-Harvest Application of Agro-Chemicals. *Middle East Journal of Scientific Research*, *9*(5), 628-637.

Khoshbakht, D. and Asgharei, M. R. (2015). Influence of foliar-applied salicylic acid on growth, gas-exchange characteristics, and chlorophyll fluorescence in citrus under saline conditions. *Photosynthetica*, *35*(3), 410 - 418.

Kumar, M. A. and Reddy, Y. N. (2008). Preliminary Investigations on the Effect of Foliar Spray of Chemicals on Flowering and Fruiting Characters of Mango cv. Baneshan. *Research Journal of Agriculture & Biological Sciences*, *7*(2), 150-156.

Ngullie, C. R., Tank, T. V. and Bhanderi, D. R. (2014). Effect of Salicylic Acid and Humic Acid on Flowering, Fruiting, Yield and Quality of Mango (*Mangifera indica* L.) cv. Kesar. *Advance Research Journal of Crop Improvement*, *5*(2), 136-139.

Nyangena, I., Owino, W., Ambuko, J. and Imathiu, S. (2019). Effect of Selected Pretreatments Prior to Drying on Physical Quality Attributes of Dried Mango

Chips. *Journal of Food Science and Technology*, *56*(8), 3854-3863.

Obeed, R. S. (2011). Enhancing the Shelf Life and Storage Ability of Flame Seedless Grape by Agrochemicals Pre -Harvest Foliar Applications. *Middle East Journal of Scientific Research*, *8*(2), 1936-1943.

Pritesh Priyaranjan, J. Rajangam, K. R. Rajadurai, K. Venkatesan, V. Premalakshmi (2022). Studies on effect of Biostimulants on Growth, Yield and Quality of Mango (*Mangifera indica* L.) cv. Imam Pasand under Ultra High Density Planting (UHDP) System. *Biological Forum – An International Journal*, *14*(3), 184-188.

Reddy, V. R., Sharma, S. R. R., Srivastav, M. and Kaur, C. (2016). Effect of Pre-Harvest Application of Salicylic Acid on Postharvest Behaviour of Amrapali Mango Fruits during Storage. *Indian Journal of Horticulture*, *73*(3), 405-409.

Ribeiro, S. M. R., Barbosa, L. C. A., Queiroz, J. H., Knodler, M. and Schieber, A. (2008). Phenolic Compounds and Antioxidant Capacity of Brazilian Mango (*Mangifera indica* L.) Varieties. *Food Chemistry*, *110*, 620-626.

Sayyari, M., Babalar, M., Kalantari, S., Martínez-Romero, D., Guillén, F., Serrano, M. and Valero, D. (2011). Vapour Treatments with Methyl Salicylate or Methyl Jasmonate Alleviated Chilling Injury and Enhanced Antioxidant Potential during Postharvest Storage of Pomegranates. *Food Chemistry*, *124*, 964–970.

Shivendra, K. and Singh, R. P. (2015). Salicylic Acid Delayed Ripening of Mango Fruits During Storage in Wooden Crates. *Green Farming*, *6*(2), 396-399.

Singh, V. K., Saini, J. P. and Misra, A. K. (2001). Response of Salicylic Acid on Flowering, Floral Malformation, Fruit Set, Yield and Associated Bio-Physical and Biochemical Characters of Mango. *Indian Journal of Horticulture*, *58*(3), 196-201.

Srivastava, K. M. and Dwivedi, U. N. (2000). Delayed Ripening of Banana Fruit by Salicylic Acid. *Plant Science*, *158*, 87–96.

Unal, B. T., Mentis, O. and Akyol, E. (2015). Effects of Exogenous Salicylic Acid on Antioxidant Activity and Proline Accumulation in Apple (*Malus domestica* L.). *Horticulture, Environment and Biotechnology*, *65*(5), 606-611.

Youssef, S. M. S., Abu El-Azm, N. A. I. and Abd Elhady, S. A. E. (2017). Frequent Foliar Sprayings of Salicylic Acid with Elevated Concentrations Enhance Growth, Yield and Fruit Quality of Strawberry (*Fragaria* × *ananassa* Duch. cv. Festival) Plants. *Egyptian Journal of Horticulture*, *44*(1), 61-74.

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