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Influences of pre harvest treatments on yield of mango cv. Amrapali

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Abstract
The present investigation was conducted during 2018-19 to find out the influences of pre harvest treatments on yield and biochemical behavior of mango cv. Amrapali. The study was framed out in a completely randomized design (CRD) with ten treatments and three repetitions. The analysis of data revealed that salicylic acid at 3000 ppm with $CaCl_2$ at 1.0 per cent significantly increased the fruit weight (257.59 g), volume (251.18 ml), number of fruits per tree (134.74) and yield (36.25 kg/tree) of mango cv. Amrapali fruits.

Keywords: Amrapali, $CaCl_2$, mango, salicylic acid, yield

Introduction
Amrapali is prominent mango hybrid in India. Amrapali (Dashehari × Neelum) is a well Known, dwarf, late maturing and regular bearer, which possesses quality with oblong fruit shape.

Despite of such a good characters, problems of fruit drops and varying fruit size have been observed. These problems may be due to genetical, environmental, cultural or hormonal factors. Pre-harvest application of growth regulators and nutrients can modify the place and direction of physical and biochemical changes in developing fruit and has potential to transform its quality at harvest.

The positive effect of salicylic acid on fruits physical properties and increase the activity of antioxidant enzyme capacity. It also inhibits ethylene biosynthesis in plant by blocking the conversion of 1-amino-cyclopropane l-carboxylic acid to ethylene (Leslie and Romain, 1986) [12]. It has been also found out that salicylic acid induces SAR (Systemic Acquired Resistance) in plants.

Pre-harvest spray of $CaCl_2$ reduces the weight loss, delays the ripening of fruits, increase the shelf life and Physico-chemical parameters of mango fruits (Karemera and Habimana, 2014a) [7].

Material and Methods
The experiment was carried out at Regional Horticultural Research Station, ASPEE College of Horticulture and Forestry, Navsari Agricultural University, Navsari during 2018-19. Geographically, Navsari is situated at 20°57' North latitude and 72°54' East longitude with an altitude of 11.89 m above the mean sea level. The study was laid out in a completely randomized design (CRD) with ten treatments and three repetitions. The solution of salicylic acid of desired concentration was prepared by dissolving required quantities in ethanol/alchohol then added in water. The solution of calcium chloride was prepared by accurately weighing on a digital balance and then dissolving it in required quantity of water. The spray applications were performed during the morning hours. Foliar spray of salicylic acid was done at 5 weeks after full bloom and calcium chloride was sprayed at 15 days before harvesting on 12 years old mango orchard planted 2.5 m × 2.5 m spacing. The result was expressed as number of fruits per tree. The total produce fruits per tree was weighted and noted the fruit yield expressed in kilogram (kg) per tree at harvest. The various treatments followed for the experiment were as under: T_1 (Absolute control), T_2 (1000 ppm Salicylic acid), T_3 (2000 ppm Salicylic acid), T_4 (3000 ppm Salicylic acid), T_5 (1000 ppm Salicylic acid + 0.5% $CaCl_2$), T_6 (1000 ppm Salicylic acid + 1.0% $CaCl_2$), T_7 (2000 ppm Salicylic acid + 0.5% $CaCl_2$), T_8 (2000 ppm Salicylic acid + 1.0% $CaCl_2$), T_9 (3000 ppm Salicylic acid + 0.5% $CaCl_2$) and T_{10} (3000 ppm Salicylic acid + 1.0% $CaCl_2$).

Fruit weight (g)
Fruit weight was measured from five randomly selected fruits by using digital weighing machine and expressed in gram.

Fruit volume (ml)
A measuring cylinder of 5 litre capacity was employed for measuring fruit volume in which water was added up to 3 litre mark. Individual fruits were dipped in water, this led to a rise in the volume of water from the 3 litre mark which was noted as the volume of fruits.

Number of fruits/tree
The number of fruits was counted treatment wise at harvest. The result was expressed as number of fruits per tree.

Yield (kg/tree)
The total produce fruits per tree were weighted and noted the fruit yield at harvest. This result was expressed in kilogram (kg) per tree.

Result and Discussion
Fruit weight: It is observed from the result that the pre-harvest application of 3000 ppm Salicylic acid and 1.0% $CaCl_2$ recorded significantly higher fruit weight (257.59 g) of mango cv. Amrapali. It might be due to the fact that salicylic acid has a direct involvement in plant growth by enhancing the level of chlorophyll and photosynthesis, control of Stomatal movement, reversion effects of ABA on leaf abscission and modifying the activity of some important enzymes (Hayat *et al.*, 2010) [6]. An increase in fruit weight could also be attributed to effects of $CaCl_2$ on formation and transformation of carbohydrates and carbohydrates enzymes. Other reason might be the reduction of abscission and influencing in maintaining the middle lamella cells (Karemera *et al*., 2014) [9]. Similar results were also found by Karemera *et al.* (2013) [8] in mango.

Fruit volume
It is clear from the result that pre-harvest application of salicylic acid 3000 ppm and 1.0% $CaCl_2$ noted significantly higher fruit volume (251.18 ml) of mango cv. Amrapali. It might be due to foliar application of Salicylic acid has improve photosynthetic activity which accumulates the carbohydrates and plant pigments. An increase in fruit volume could also be attributed to effects of $CaCl_2$ on influencing formation and transformation of carbohydrates and carbohydrate enzymes (Karemera *et al*., 2014) [9]. Similar results were also found by Karemera *et al.* (2013) [8] in mango.

Number of fruits per tree
It was observed from the result that application of 3000 ppm salicylic acid and 1.0 per cent $CaCl_2$ recorded significantly higher number of fruits (134.74) per tree of mango cv. Amrapali. The application of salicylic acid also inhibits the putative ethylene forming enzyme (EFE) that converts 1-aminocyclopropane - 1 - carboxylic acid (ACC) to ethylene. Therefore, it is highly probable that aqueous spraying of salicylic acid may have interfered with the biosynthesis/action of ethylene, which in turn reduced fruitlet abscission and enhanced fruit retention. Another possible reason for increased fruit retention might be due to better photosynthetic activity (Ngullie *et al.*, 2014) [15]. This activity might be due to contributed significant increase in number of fruits per tree in the present study. Similar results were also found by Ahmed *et al*. (2015) [1], Ahmed *et al*. (2013) [2] and Naqvi *et al*. (1998) [14] in mango; Masoud and Osama (2012) [13] in Washington Navel Orange and Qureshi *et al*. (2013) [16] in strawberry.

Yield
Significantly the maximum yield (36.25 kg/tree) of mango cv. Amrapali was obtained from application of 3000 ppm salicylic acid and 1.0% $CaCl_2$. It might be due to application of salicylic acid which might have attributed an increase in phosynthesis activity in leaves and translocation of more photoassimilates to fruits (Ngullie *et al.*, 2014) [15]. The increase in the yield by application of calcium might have the role of calcium in cell formation and its prevention of cellular degeneration. Calcium is an important mineral in the formation of cell membrane and development hence increases in the fruit physical attributes. (Bitange *et al*., 2019) [3]. Moreover, the higher yield may be due to increase in numbers of fruits per tree which ultimately increase the yield of mango cv. Amrapali in this study. Similar findings were obtained by Ahmed *et al.* (2015) [1], Faissal *et al.* (2014) [5], Ahmed *et al.* (2013) [2] and Singh *et al.* (2001) [17] in mango; El-Razek *et al.* (2013) [4] in Olive; Kazemi (2015) [11] in strawberry and Kassem *et al*. (2011) [10] in grape.

Table 1: Effect of pre-harvest treatments on fruit weight, volume, number of fruits/tree and yield of mango cv. Amrapali

Treatments	Fruit weight (g)	Fruit volume (ml)	Number of fruits/ tree	Yield (kg/tree)
T_1: Absolute control	240.35	234.58	80.56	18.84
T_2: 1000 ppm Salicylic acid	243.41	236.64	89.92	22.26
T_3: 2000 ppm Salicylic acid	243.66	236.87	105.43	26.97
T_4: 3000 ppm Salicylic acid	244.85	237.42	90.77	23.59
T_5: 1000 ppm Salicylic acid + 0.5% $CaCl_2$	244.10	237.23	107.20	27.66
T_6: 1000 ppm Salicylic acid + 1.0% $CaCl_2$	244.97	238.67	117.80	29.83
T_7: 2000 ppm Salicylic acid + 0.5% $CaCl_2$	243.88	237.12	123.96	30.64
T_8: 2000 ppm Salicylic acid + 1.0% $CaCl_2$	247.51	241.42	130.51	34.01
T_9: 3000 ppm Salicylic acid + 0.5% $CaCl_2$	255.24	247.15	128.90	33.84
T_{10}: 3000 ppm Salicylic acid + 1.0% $CaCl_2$	257.59	251.18	134.74	36.25
S.Em ±	0.24	0.11	3.36	0.99
CD at 5%	0.70	0.32	9.92	2.93
CV%	0.17	0.08	5.25	6.06

Conclusion

On the basis of results obtained in the present investigation it is concluded that the foliar application of Salicylic acid (5 week after full bloom) at 3000 ppm and $CaCl_2$ (15 days before harvest) at 1.0 per cent resulted in maximum fruit weight, volume, number of fruits per tree and yield of mango cv. Amrapali. These results, however, need to be further confirmed on multi-location large scale trials before passing as recommendations to the mango growers of South Gujarat.

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