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Studies on Foliar Application of Growth Regulators on Fruit Quality of Guava cv. Taiwan Pink

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ABSTRACT: The present investigation entitled "Studies on foliar application of growth regulators on fruit quality of guava cv. Taiwan pink" was carried out at Department of Fruit Science, Dr. YSRHU-College of Horticulture, Venkataramanannagudem, West Godavari district of Andhra Pradesh during January 2023 to August 2023. The experiment was laid out in a Randomized Block Design (RBD) with nine treatments and each treatment replicated thrice. The results revealed that the fruits harvested from the plants sprayed with Ethrel @ 500ppm + GA_3 @ 200ppm + NAA @ 300ppm(T_4) had showed significant effect on quality attributes *viz*., maximum TSS (10.04 °Brix), TSS/Acid ratio (33.47), total sugars (7.17 %), reducing sugars (4.58 %), non-reducing sugars (2.59 %), ascorbic acid content (219.53 mg 100 g^{-1}pulp) and lowest titrable acidity (0.30 %). While minimum TSS (8.35 °Brix), TSS/Acid ratio (13.92), total sugars (5.76 %), reducing sugars (4.03 %), non-reducing sugars (1.73 %), ascorbic acid content (190.74 mg 100 g^{-1}) and highest titrable acidity (0.60 %) was recorded in control-water spray (T_9).

Keywords: Guava, Ethrel, GA_3, NAA, quality parameters.

INTRODUCTION

Guava (*Psidium guajava* L.,) often called as the "Apple of the Tropics" or "Poor man's fruit" belongs to Myrtaceae family. In India it is the fourth most important fruit crop after mango, banana and citrus in both area and production. It is believed to have been introduced in India as early as 17th century, presently occupying an area of 315 thousand hectares and has an annual production of 49.16 MT. Though, it is successfully grown all over the country, the important guava growing states in India are Karnataka, Andhra Pradesh, Uttar Pradesh, Madhya Pradesh and Maharashtra .The state of Andhra Pradesh has 14.57 thousand hectares area with an annual production of 335.11 MT (Anonymous, 2022).

Guava comes to flowering for two to three times a year in North India, *viz.*, *ambebahar* (February-March), *mrigbahar* (June-July) and *hasthbahar* (October-November) seasons and three times a year in South India (Samson, 1980). About 80 to 86 per cent of flowers are set into fruits, but 34 to 56 per cent of fruits only attained maturity due to fruit drop (Singh and Hoda 1996). Smitha and Samach (2013) found that high crop load of fruit trees led to the weakness of tree vigour and affected the development of leaves which resulted in the fruit trees senescence at later growth stage. Several investigations (Dutta and Banik 2006) were conducted to reduce the rainy season crop and to enforce more winter season crop by means of mechanical flower thinning by the use of growth substances like naphthalene acid amide (NAD), 2,4-dichlorophenoxy acetic acid (2,4-D), dinitro ortho-cresol (DNOC) and Ethrel (2-chloroethyl phosphonic acid).

The application of ethrel was considered as a key element causing high flower bud abscission. The increase in ethylene concentration of the plant tissues increases the sensitivity of the abscission layer to ethylene, which triggers the organ to fall due to the synthesis of enzymes that hydrolyse the cell wall, such as cellulase and polygalacturonase (Iqbal *et al*., 2017). Auxin plays important role in cell division, cell elongation, shortening of internodes, root initiation, apical dominance, prevention of abscission layer, production of parthenocarpic fruits and to control fruit drop. Gibberellin plays important role in size, shape, weight, fruit set and fruit retention of the tree. It is synthesized in young tissues of the shoot and in developing seed. Application of exogenous gibberellin invariably causes an increase in the level of alpha amylase and RNA, using cDNA and recombinant DNA cloning methods.

The prolific blossoming and bearing in *ambe bahar* exhausts food reserves leaving insufficient reserves for the next crop season. The objective of flower abscission in fruit trees is to reduce number of fruits per plant, promoting sink: source balance and reducing competition among fruits. Hence, the use of growth regulators to improve fruit quality by regulating flowering is studied.

MATERIAL AND METHODS

The current research, "Studies on foliar application of growth regulators on fruit quality of guava cv. Taiwan pink" was carried out at Department of Fruit Science, Dr. YSRHU-College of Horticulture, Venkataramanannagudem, West Godavari district of Andhra Pradesh during January 2023 to August 2023. The experimental site was located at an altitude of 34 m (112 feet) above mean sea level receiving annual rainfall of 900mm. The experiment was laid out in a Randomized Block Design (RBD) with nine treatments and each replicated thrice *viz*.,T_1: Ethrel @ 500ppm + GA_3 @ 100ppm + NAA @ 200ppm, T_2: Ethrel @ 500ppm + GA_3 @ 100ppm + NAA @ 300ppm, T_3: Ethrel @ 500ppm + GA_3 @ 200ppm + NAA @ 200ppm, T_4: Ethrel @ 500ppm + GA_3 @ 200ppm + NAA @ 300ppm, T_5: GA_3 @ 100ppm + NAA @ 200ppm, T_6: GA_3 @ 100ppm + NAA @ 300ppm, T_7: GA_3 @ 200ppm + NAA @ 200ppm, T_8: GA_3 @ 200ppm + NAA @ 300ppm, T_9: Control-water spray.Observations were recorded on quality parameters like TSS (°Brix), titrable acidity (%), TSS/Acid ratio, total sugars (%), reducing sugars(%), non-reducing sugars (%) and ascorbic acid (mg 100 g^{-1} pulp).

The total soluble solids (TSS) were determined by using hand refractometer. The titrable acidity in fruit pulp was determined by titrating the sample extracted in water against 0.1N NaOH as described by Ranganna (1986). The TSS/Acid ratio was calculated by dividing the value of total soluble solid of guava fruit pulp by per cent acidity of guava fruit pulp. The total, reducing and non-reducing sugars were estimated as per the procedure described by Lane and Eyon (AOAC, 1980) method. The ascorbic acid content was estimated as per the procedure described by Ranganna (1986).

RESULTS AND DISCUSSION

Total soluble solids (°Brix). The data pertaining to total soluble solids of guava cv. Taiwan pink was presented in Table 1. The total soluble solids were maximum in fruits harvested from the plants sprayed with Ethrel @ 500ppm + GA_3 @ 200ppm + NAA @ 300ppm (T_4) (10.04 ^{o}Brix) which was on par with Ethrel @ 500ppm + GA_3 @ 200ppm + NAA @ 200ppm (T_3) (9.88^{o}Brix) whereas the lowest TSS (8.35 ^{o}Brix) was recorded in control-water spray (T_9). The maximum TSS was observed in fruits harvested from plants sprayed with Ethrel @ 500ppm + GA_3 @ 200ppm + NAA @ 300ppm might be due to by application of growth regulators which proved highly helpful in the process of photosynthesis and mobilization of food materials leading to the accumulation of quality constituents like carbohydrates which ultimately promoted the quality attributes and quick metabolic transformation of starch and pectin into soluble compounds and rapid transformation of sugars from leaves to developing fruits as reported by Katiyar *et al*. (2008) in guava. Similar results were reported by Shreef *et al*. (2016) in guava and Lenka *et al*. (2019) in guava cv. Allahabad Safeda.

Titrable acidity (%). The data on titrable acidity of guava fruits as influenced by the foliar application of growth regulators was presented in Table 1. The data depicted that lowest titrable acidity was observed in fruits sprayed with Ethrel @ 500ppm + GA_3 @ 200ppm + NAA @ 300ppm (T_4) (0.30 %) whereas the highest titrable acidity (0.60 %) was recorded in fruits harvested from control sprayed plants (T_9). Lowest titrable acidity might be due to early ripening of fruits influenced by the treatment, where acid might have been used during respiration or faster conversion in to sugars in fruit. Similar results were reported by Osama *et al*. (2015) in mango and Prajapati and Singh (2018) in guava.

TSS/Acid ratio. There was a significant difference among the treatment effects for TSS/Acid ratio and presented in Table-1. However, fruits sprayed with Ethrel @ 500ppm + GA_3 @ 200ppm + NAA @ 300ppm (T_4) (33.47) had significantly retained the maximum TSS/Acid ratio followed by Ethrel @ 500ppm + GA_3 @ 200ppm + NAA @ 200ppm (T_3) (29.94). The minimum TSS/Acid ratio (13.92) was recorded in water spray fruits (T_9). Maximum TSS/Acid ratio in guava fruit pulp might be due to guava fruit pulp low in acidity and high TSS with Ethrel @ 500ppm + GA_3 @ 200ppm + NAA @ 300ppm treatments as compared to all other treatments.

Total sugars (%). Table 1 shows the per cent total sugars in guava cv. Taiwan pink fruit pulp. There was a significant difference between treatments and highest total sugars (7.17 %) were observed in Ethrel @ 500ppm + GA_3 @ 200ppm + NAA @ 300ppm (T_4) followed by Ethrel @ 500ppm + GA_3 @ 200ppm + NAA @ 200ppm (T_3) (7.05 %) and the per cent total sugars were found less (5.76 %) in fruits harvested from the plants without any growth regulator spray (control) treatment (T_9).

Reducing sugars (%). The data obtained on reducing sugars of guava fruits as influenced by the application of growth regulators sprays was presented in Table 1. The plants sprayed with Ethrel @ 500ppm + GA_3 @ 200ppm + NAA @ 300ppm (T_4) had recorded the highest reducing sugars (4.58 %) as compared to other treatments followed by Ethrel @ 500ppm + GA_3 @ 200ppm + NAA @ 200ppm (T_3) (4.54 %). The lowest reducing sugars (4.03 %) were observed in water spray (T_9).

Non-reducing sugars (%). The data regarding to percentage of non-reducing sugars are presented in the Table 1. It showed that the treatments had significant influence on percentage of non-reducing sugars. The highest percentage of non-reducing sugar (2.59 %) was found in fruits sprayed with Ethrel @ 500ppm + GA_3 @ 200ppm + NAA @ 300ppm (T_4) followed by Ethrel

@ 500ppm + GA_3 @ 200ppm + NAA @ 200ppm (T_3) (2.51 %) whereas, fruits with water spray (T_9) recorded lowest non-reducing sugar percentage (1.73 %)

The total sugars, reducing sugars and non-reducing sugars in fruits harvested from the plants sprayed with Ethrel @ 500ppm + GA_3 @ 200ppm + NAA @ 300ppm might be due to the application of growth regulators proved highly useful in the process of photosynthesis and mobilization of food material leading to the accumulation of quality constituents like carbohydrates which ultimately promoted the quality attributes and quick metabolic transformation of starch and pectin into soluble compounds and rapid transformation of sugars from leaves to developing fruits as reported by Katiyar *et al*. (2008) in guava. Similar results were reported by Anawal *et al*. (2015) in pomegranate and Karole and Tiwari (2016) in ber.

Ascorbic acid (mg 100 g $^{-1}$). The data pertaining to ascorbic acid content of guava fruit pulp as influenced by the different growth regulator sprays were presented in Table 1. The maximum ascorbic acid content was recorded in fruits of plants sprayed with Ethrel @ 500ppm + GA_3 @ 200ppm + NAA @ 300ppm (T_4) (219.53 mg 100 g^{-1}) which was on par with Ethrel @ 500ppm + GA_3 @ 200ppm + NAA @ 200ppm (T_3) (217.84 mg 100 g^{-1}) whereas the lowest TSS (190.74 mg 100 g^{1}) was recorded in fruits taken from the plants with water spray (T_9). The highest ascorbic acid content was found in fruit pulp of Ethrel @ 500ppm + GA_3 @ 200ppm + NAA @ 300ppm treated fruits which might due to the catalytic effect of growth regulators on the biosynthesis of ascorbic acid from its precursor glucose 6 phosphate or inhibited ascorbic acid conversion to dehydroascorbic acid by an oxidative enzyme ascorbic acid oxidase, which would have resulted in higher ascorbic content of fruit as opined by Shreef *et al*. (2016) in guava. Similar results were reported by Garasiya *et al*. (2013) in guava cv. L-49, Manivannan *et al*. (2017) in guava and Prajapati *et al*. (2016) in custard apple.

The treatments (T_4, T_3, T_2, T_1) were observed to be better than treatments (T_8, T_7, T_6, T_5) for quality parameters *viz*., TSS, Acidity, TSS/Acid ratio, total sugars, reducing sugars, non-reducing sugars and ascorbic acid content. This is due to flower abscission in fruit trees is to reduce number of fruits per plant, promoting sink: source balance and reducing competition among fruits, which results in improvement of fruit quality parameters (Smith and Samach 2013).

Table 1: Effect of foliar application of growth regulators on fruit quality of guava cv. Taiwan pink.

Treatment	TSS (°B)	Acidity (%)	TSS/Acid ratio	Ascorbic acid (mg 100 g $^{-1}$)	Reducing sugars (%)	Non reducing sugars (%)	Total sugar (%)
Ethrel @500ppm+GA_3@100ppm+NAA @200ppm	9.58	0.38	25.21	213.37	4.45 (2.33*)	2.41 (1.85*)	6.86 (2.80*)
Ethrel @500ppm+GA_3@100ppm+NAA @300ppm	9.74	0.35	27.83	214.45	4.49 (2.34)	2.45 (1.86)	6.94 (2.81)
Ethrel @500ppm+GA_3@200ppm+NAA @200ppm	9.88	0.33	29.94	217.84	4.54 (2.35)	2.51 (1.87)	7.05 (2.84)
Ethrel @500ppm+GA_3@200ppm+NAA @300ppm	10.04	0.30	33.47	219.53	4.58 (2.36)	2.59 (1.90)	7.17 (2.86)
GA_3 @ 100ppm + NAA @ 200ppm	8.87	0.53	16.74	196.02	4.17 (2.27)	2.06 (1.75)	6.23 (2.69)
GA_3 @ 100ppm + NAA @ 300ppm	9.01	0.51	17.67	197.25	4.23 (2.28)	2.08 (1.75)	6.31 (2.70)
GA_3 @ 200ppm + NAA @ 200ppm	9.15	0.47	19.47	200.34	4.28 (2.29)	2.18 (1.78)	6.46 (2.73)
GA_3 @ 200ppm + NAA @ 300ppm	9.31	0.44	21.16	203.51	4.31 (2.30)	2.27 (1.81)	6.58 (2.75)
Control - water spray	8.35	0.60	13.92	190.74	4.03 (2.24)	1.73 (1.65)	5.76 (2.60)
CD at 5%	0.465	0.026	0.993	6.908	0.035	0.030	0.057
SE m±	0.154	0.009	0.328	2.284	0.011	0.010	0.019

***** Figures in parenthesis are square root transformed values

CONCLUSIONS

On the basis of results obtained in the present investigation, it could be concluded that, the fruits sprayed with (T_4) Ethrel @ 500ppm + GA_3 @ 200ppm + NAA @ 300ppm have showed better results in terms of fruit quality attributes *viz.*, TSS, titrable acidity, TSS/Acid ratio, reducing sugars, non-reducing sugars, total sugars and ascorbic acid content.

FUTURE SCOPE

The use of growth regulators in present investigation showed effect on fruit quality by controlling the flowering. Therefore, the experiment should be done with other commercial varieties of guava and different concentrations of ethrel need to be studied.

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Conflict of Interest. None.

REFERENCES

Anawal, V. V., Narayanaswamy, P. and Ekabote, S. D. (2015). Effect of plant growth regulators on fruit set and yield of pomegranate cv. Bhagwa. *International Journal of Scientific Residue*, *4*(9), 2277-2279.

Anonymous (2022). Crop wise area and production of Horticultural Crops. 2nd advance estimate (2021-2022), National Horticulture Board, Ministry of Agriculture and Farmer's welfare, Government of India, New Delhi.

A. O. A. C. (1980). Official methods of analysis association of official analytical chemists. 15th edition Washington, D.C. USA.

Dutta, P. and Banik, A. K. (2006). Effect of foliar feeding of nutrients and plant growth regulators on physico-chemical quality of sardar guava grown in red and

lateritic tract of West Bengal. *International Society for Horticultural Science*, *57*, 407-411.

Garasiya, V. R., Patel, N. M., Bhadauria, H.S. and Wankhade, V. R. (2013). Effect of plant growth regulators on quality of winter season guava (*Psidium guajava* L.) cv. L-49 (Sardar). *International Journal of Agricultural Sciences*, *9*(11), 1893-1896.

Iqbal, M., Khan, M. Q., Jalal-ud-Din, R. and Munir, M. (2009). Effect of foliar application of NAA on fruit drop, yield and physico-chemical characteristics of guava (*Psidium guajava* L.) red flesh cultivar. *Journal of Agricultural Research*, *47*(3), 259-269.

Karole, B. and Tiwari, R. (2016). Effect of Pre-harvest spray of growth, yield and quality of ber under malwa plateau conditions. *Annals of Plant and Soil Research*, *18*(1), 18–22.

Katiyar, P. N., Singh, J. P., Singh, P. C. and Gangawar, A. P. S. (2008). Effect of pre-harvest application of plant growth regulators on post-harvest quality of originally grown guava (*Psidium guajava* L.) fruits. *Asian Journal of Horticulture*, *3*, 330-332.

Lenka, J., Acharya, G. C., Sahu, P., Dash, D. K., Samant, D., Panda, C. M., Mishra, K. N. and Panda, R. K. (2019). Effect of foliar nutrition of micronutrients and plant growth regulators on yield and quality of guava (*Psidium guajava* L.) cv. Allahabad Safeda. *International Journal of Chemical Studies*, *7*(5), 1327-333.

Manivannan, M. I., Irulandi, S. and Shoba Thingalmaniyan, K. (2017). Studies on the effect of pre-harvest application of plant growth regulators and chemicals on yield and quality of guava (*Psidium guajava* L.) cv. L-49. *International Journal of Agricultural Sciences*, *11*(1), 138-140.

Osama, H. M. E. G., Amro, S. M. S. and Saber, M. M. B. (2015). Effect of growth regulators, antioxidant and application date on fruiting and fruit quality of mango cv. Keitt. *IOSR - Journal of Agriculture and Veterinary Science*, *8*(12), 87- 95.

Prajapati, M. and Singh, D. (2018). Effect of plant growth regulators on flowering, fruit growth and quality of guava (*Psidium guajava* L.). cv. Allahabad safeda. *International Journal of Current Microbiology and Applied Sciences*, *7*, 3355-3361.

Prajapati, R. D., Laua, H. N., Solanki, P. D. and Parekh, N. S. (2016). Effect of plant growth regulators on flowering, fruiting, yield and quality parameters of custard apple (*Annona squamosa* Linn.) cv. Local. *Ecology Environment and Conservation*, *22*, 9-11.

Ranganna, S. (1986). Handbook of analysis and quality control for fruits and vegetable products (second edition). *Tata McGraw-Hill publishing company limited*, New Delhi, 9-10.

Samson, J. A. (1980). *Tropical Fruits*. Longman, London and New York, pp.215-216.

Shreef, M., Mohammad, N., Hasan, Sheikh, M., Younus, A., Rafiza, A. R. and Mohammad, G. H. (2016). Effect of plant growth regulators on fruit-set and quality of guava. *Turkish Journal of Agriculture Food Science and Technology*, *4*(12), 1088-1091.

Singh, S. and Hoda, M. N. (1996). Report on Fruit Research at Sabour, Rajendra Agricultural University, Pusa (India), pp.74-77.

Smitha, H. M. and Samach, A. (2013). Constraints to obtaining consistent annual yields in perennial tree crops. *Plant Sciences*, *207*, 158-167.

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