

EFFECT OF BEST PLANT BIO-REGULATORS AND MICRONUTRIENT FOR GETTING HIGHER FRUIT SETTING IN MANGO (*MANGIFERA INDICA* L.) CV. AMRAPALI

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Abstract: An investigation was carried out on 19 years old plantation of mango (*Mangifera indica* L.) cv. Amrapali at C.S.A.U.A.&T., Kanpur (U.P.) India, during the year 2013-2014. In all, 15 treatments foliar application of plant bio-regulators and micronutrient were tested in RBD design replicated thrice. The result concluded that pre-harvest application of GA₃ (40 ppm) + ZnSO₄ (1.0%) results in significant decrease in fruit drops, increase in fruit retention. The application of NAA (40 ppm) + ZnSO₄ (0.5%) results in significantly increase the number of fruits set per plant and minimum fruit set under control.

Keywords: Mango, GA₃, NAA, Zinc sulphate, Fruit drop

INTRODUCTION

The mango (*Mangifera indica* L.) occupies a pre-eminent place amongst the fruit crops grown in India due to its wide adaptability, high nutritive value, richness in variety, delicious taste, pleasant flavor, attractive colour. Mango belongs to family Anacardiaceae and one of the most important and delicious fruit of the tropical countries and holds a premier position amongst the commercial fruits, grown in India. It is also known as king of fruits and national fruit of India. Mango industry has vast potentiality to play a vital role in the development of economic status of the country and better linkage in the international trade. It is indigenous to north-east India and north Myanmar in the foot-hills of the Himalaya and is said to have originated in the Indo-Burma region.

The major mango producing countries are including India, Bangladesh, Burma, Sri Lanka, China, Malaysia, Florida, Hawaii, Mexico, Thailand, Australia, Pakistan, Indonesia, Philippines. In India, its cultivation is mentioned since pre-historic times for more than 4000 years ago. India has a rich wealth of mango germplasm with more than 1000 varieties grown throughout the country. However, only about 21 of them are commercially cultivated in different regions (Yadav, 1997). The most well-known commercially cultivated varieties in the northern region of India are Bombay Green, Langra, Dashehari, Lucknow Safeda and Chausa. Almost all northern cultivars are biennial in bearing habit. Consequently, a large number of promising hybrids have been evolved by desirable combinations to obtain regular bearing varieties. Among the promising mango hybrids, Amrapali is a well-known late maturing regular bearing dwarf hybrid. Fruit possesses excellent quality with high pulp per cent and TSS with deep orange red flesh colour and excellent taste.

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Well suited hybrid cultivar for commercial cultivation in the northern region of the country. It was evolved at IARI, New Delhi as a result of cross between Dashehari (alternate bearer) and Neelum (regular bearer) in 1978. 'Amrapali' is superior in comparison to parents in fruit quality like high percentage of pulp, TSS, acidity and β-carotene content.

The foliar application of plant bio-regulators and micronutrients has an immense important role in improving fruit set, productivity and quality of fruits. It has also a beneficial role in the recovery of nutritional and physiological disorders in fruit trees. Foliar application is based on the principle that the nutrients are quickly absorbed by leaves and transported to different parts of the plant to fulfil the functional requirements of nutrition. Foliar application of nutrient is obviously an ideal way to evade the problem of nutrient availability. This method is highly helpful for the correction of trace element deficiencies, to restore disrupted nutrient supply and to overcome stress factors limiting their availability. This method has been commercialized in a number of fruit crops like Citrus, Pineapple and Guava etc.

Plant bio-regulators and micronutrient such as GA₃, NAA and ZnSO₄ play an important role for fruit set, fruit yield and quality. Zinc plays an important role in growth and development of fruits, vegetables and cereals. It is one of the essential elements for the formation of chlorophyll and hence useful towards photosynthetic activity. Zinc is a constituent of some enzymes, indole acetic acid in plants and essential for CO₂ evolution, utilization of carbohydrate, phosphorus metabolism and synthesis of proteins. Naphthalene acetic acid is helpful in the induction of flowering, prevent shedding of buds, flowers and unripe fruits, enlarge fruit size and also increase the yield and quality of many fruits, whereas, GA₃

application is found more effective in retaining the maximum fruit percentage per panicle with increase in fruit size and fruit weight in mango and in many other fruits.

Deficiency of auxins, gibberellins and cytokinins as well as high level of inhibitors appears to be the cause of fruit drop in mango trees (Krisanapook *et al.*, 2000). Plant growth regulators have primitive role in minimizing the fruit drop at different stages. Plant growth regulators have potential to enhance productivity of fruits by bringing out a change in nutritional and hormonal status of the plant (Tripathi *et al.*, 2006). Naphthalene acetic acid and CPPU are control fruit drop-reducing PGR. Many investigators found that, spraying mango trees with NAA at different concentrations increased fruit set percentages and fruit retention CPPU, like their natural analogs, it is known for promoting cell division and is therefore used for the increasing of fruit growth. CPPU increased fruit retention in different mango cultivars and growing regions (Burondkar *et al.*, 2009 and Notodimedjo, 2000). Considering the problem of fruit drop and fruit setting, the investigation was carried out to study the effect of different PGRs viz., NAA (40 ppm) and CPPU (10 and 20 ppm) on fruiting, yield and quality characters of mango cv. Keshar. Naphthalene acetic acid (NAA) @ 80 ppm spray at 30 days before flowering was found to improve flowering in mango (Davenport, 2007).

MATERIALS AND METHODS

The present investigation was carried out in the Department of Horticulture, Chandra Shekhar Azad University of Agriculture and Technology, Kanpur (U.P.) during 2013-2014. The 45 Mango trees having uniform growth were selected randomly for the study. The cultural operations and basal application of manures and fertilizers were applied as per recommended schedule for Mango plantation. In all 15 treatments viz., T₁-GA₃ (20 ppm), T₂-GA₃ (40 ppm), T₃-NAA (20 ppm), T₄-NAA (40 ppm), T₅-ZnSO₄ (0.5%), T₆-ZnSO₄ (1.0%), T₇-GA₃ (20 ppm) + ZnSO₄ (0.5%), T₈-GA₃ (20 ppm) + ZnSO₄ (1.0%), T₉-GA₃ (40 ppm) + ZnSO₄ (0.5%), T₁₀-GA₃ (40 ppm) + ZnSO₄ (1.0%), T₁₁-NAA (20 ppm) + ZnSO₄ (0.5%), T₁₂-NAA (20 ppm) + ZnSO₄ (1.0%), T₁₃-NAA (40 ppm) + ZnSO₄ (0.5%), T₁₄-NAA (40 ppm) + ZnSO₄ (1.0%), T₁₅-Control (water spray) were tested in randomized block design with 3 replications. spraying of plant bio regulators and micro-nutrient was done at pea stage of fruit set. Thereafter observations were recorded Number of fruits set per plant, Fruit drop (%), Fruit retention

(%) and Number of fruits per plant.

RESULT AND DISCUSSION

The number of fruits set per plant was counted at pea stage and average number of fruits per plant was expressed presented in Table 1. The data pertaining to the number of fruits set per plant clearly indicate that plants treated with GA₃, NAA and zinc sulphate significantly increased the number of fruits set per plant as compared to untreated ones. The pre-harvest application of plant bio-regulators and micronutrient produced significantly higher number of fruits set per plant with the pre-harvest application of NAA (40 ppm) + ZnSO₄ (0.5%) and this number of fruits set per plant was significantly higher as compared to remaining all other treatments whereas, the minimum number of fruits set per plant was recorded under control. Among both plant bio-regulators, maximum number of fruits set per plant was recorded in GA₃ (20 ppm) treated plants closely followed by NAA (40 ppm) whereas, minimum number of fruits set per plant was recorded in NAA (20 ppm) treated plants. The number fruits drops per plant are presented in Table 2. Data pertaining to the drop per cent of fruits, it is clearly indicated that significantly minimum fruit drop per cent was obtained with the pre-harvest application of GA₃ (40 ppm) + ZnSO₄ (1.0%) and fruit drop per cent was significantly lowest as compared to remaining all other treatments under investigation. Among both plant bio-regulators, minimum fruit drop per cent was recorded in GA₃ 40 ppm treated plants closely followed by NAA (20 ppm), whereas, maximum fruit drop per cent was recorded in GA₃ (20 ppm) treated plants. Data pertaining of retention of fruit per cent presented in Table 3. The significantly maximum fruit retention per cent was obtained with the pre-harvest application of GA₃ (40 ppm) + ZnSO₄ (1.0%) which is significantly higher than remaining all other treatments, except T₉ and T₂, which produced 13.90% and 13.73%, respectively, whereas, the minimum fruit retention per cent was recorded under control. The maximum fruit retention per cent was recorded in GA₃ (40 ppm) treated plants, which is statistically at par with NAA (20 ppm); whereas, the minimum fruit retention per cent was recorded in GA₃ (20 ppm) treated plants. The number of fruits per plant at harvesting time presented in Table 4. The significantly maximum fruits per plant was obtained with the pre-harvest application of NAA (40 ppm) + ZnSO₄ (0.5%) followed by 226 fruits with NAA (40 ppm) + ZnSO₄ (1.0%) treated plants and this number of fruits per plant was significantly higher than remaining all other treatments, whereas, the minimum fruits per plant was recorded under control. It is also observed that among both plant bio-regulators, the maximum fruits per plant was recorded in plants treated with NAA (40 ppm) followed by GA₃ (20 ppm), whereas, minimum fruits

per plant was recorded in NAA (20 ppm) treated plants. These results are in accordance with Ruby and Rani (2001) in litchi, Tripathi and Shukla (2010) in strawberry and Kumar *et al.* (2008) and Vashistha *et al.* (2010) in mango cv. Amrapali. Bhowmick and Banik (2011) also recorded maximum fruit retention percentage (7.25%) as well as maximum number of fruits at harvest (790.17/plant) with GA₃ at 40ppm.

The present finding is also in conformity with Tripathi and Shukla (2008), Singh and Tripathi (2010) in strawberry. Ruby and Rani (2004), also noted higher yield with GA₃ (100 ppm) higher yield as well as greatest length, diameter, volume and weight of fruit with GA₃ (200 ppm) in mango cv. Amrapali.

Table 1. Effect of pre-harvest application of plant bio-regulators and micronutrient on number of fruits set per plant.

| Treatments | Number of fruits set/plant |
|---|----------------------------|
| T ₁ : GA ₃ (20 ppm) | 2025 |
| T ₂ : GA ₃ (40 ppm) | 2021 |
| T ₃ : NAA (20 ppm) | 1988 |
| T ₄ : NAA(40 ppm) | 2022 |
| T ₅ : ZnSO ₄ (0.5%) | 1979 |
| T ₆ : ZnSO ₄ (1.0%) | 1977 |
| T ₇ : GA ₃ (20 ppm) + ZnSO ₄ (0.5%) | 2023 |
| T ₈ : GA ₃ (20 ppm) + ZnSO ₄ (1.0%) | 2020 |
| T ₉ : GA ₃ (40 ppm) + ZnSO ₄ (0.5%) | 2013 |
| T ₁₀ : GA ₃ (40 ppm) + ZnSO ₄ (1.0%) | 2009 |
| T ₁₁ : NAA (20 ppm) + ZnSO ₄ (0.5%) | 2019 |
| T ₁₂ : NAA (20 ppm) + ZnSO ₄ (1.0%) | 2016 |
| T ₁₃ : NAA (40 ppm) + ZnSO ₄ (0.5%) | 2035 |
| T ₁₄ : NAA (40 ppm) + ZnSO ₄ (1.0%) | 2026 |
| T ₁₅ :Control (water spray) | 1877 |
| S. E. m ± | 9.795 |
| CD at 5% | 28.383 |

Table 2. Influence of pre-harvest application of plant bio-regulators and micronutrient on fruit drop (%).

| Treatments | Fruit drop (%) |
|---|----------------|
| T ₁ : GA ₃ (20 ppm) | 90.69 |
| T ₂ : GA ₃ (40 ppm) | 86.27 |
| T ₃ : NAA (20 ppm) | 87.84 |
| T ₄ : NAA(40 ppm) | 89.11 |
| T ₅ : ZnSO ₄ (0.5%) | 92.47 |
| T ₆ : ZnSO ₄ (1.0%) | 91.83 |
| T ₇ : GA ₃ (20 ppm) + ZnSO ₄ (0.5%) | 89.15 |
| T ₈ : GA ₃ (20 ppm) + ZnSO ₄ (1.0%) | 87.20 |
| T ₉ : GA ₃ (40 ppm) + ZnSO ₄ (0.5%) | 86.10 |
| T ₁₀ : GA ₃ (40 ppm) + ZnSO ₄ (1.0%) | 85.15 |
| T ₁₁ : NAA (20 ppm) + ZnSO ₄ (0.5%) | 91.19 |
| T ₁₂ : NAA (20 ppm) + ZnSO ₄ (1.0%) | 90.95 |
| T ₁₃ : NAA (40 ppm) + ZnSO ₄ (0.5%) | 92.32 |
| T ₁₄ : NAA (40 ppm) + ZnSO ₄ (1.0%) | 92.95 |
| T ₁₅ :Control (water spray) | 94.85 |
| S. E. m ± | 0.933 |
| CD at 5% | 2.716 |

Table 3. Influence of pre-harvest application of plant bio-regulators and micronutrient on fruit retention per cent.

| Treatments | Fruit retention (%) |
|---|---------------------|
| T ₁ : GA ₃ (20 ppm) | 9.31 |
| T ₂ : GA ₃ (40 ppm) | 13.73 |
| T ₃ : NAA (20 ppm) | 12.16 |
| T ₄ : NAA(40 ppm) | 10.89 |
| T ₅ : ZnSO ₄ (0.5%) | 7.53 |

| | |
|---|-------|
| T ₆ : ZnSO ₄ (1.0%) | 8.17 |
| T ₇ : GA ₃ (20 ppm) + ZnSO ₄ (0.5%) | 10.85 |
| T ₈ : GA ₃ (20 ppm) + ZnSO ₄ (1.0%) | 12.80 |
| T ₉ : GA ₃ (40 ppm) + ZnSO ₄ (0.5%) | 13.90 |
| T ₁₀ : GA ₃ (40 ppm) + ZnSO ₄ (1.0%) | 14.85 |
| T ₁₁ : NAA (20 ppm) + ZnSO ₄ (0.5%) | 8.81 |
| T ₁₂ : NAA (20 ppm) + ZnSO ₄ (1.0%) | 9.05 |
| T ₁₃ : NAA (40 ppm) + ZnSO ₄ (0.5%) | 7.68 |
| T ₁₄ : NAA (40 ppm) + ZnSO ₄ (1.0%) | 7.05 |
| T ₁₅ : Control (water spray) | 5.15 |
| S. E. m ± | 0.450 |
| CD at 5% | 1.310 |

Table 4. Influence of pre-harvest application of plant bio-regulators and micronutrient on number of fruits per plant at harvest.

| Treatments | Number of fruits/plant at harvest |
|---|-----------------------------------|
| T ₁ : GA ₃ (20 ppm) | 215 |
| T ₂ : GA ₃ (40 ppm) | 211 |
| T ₃ : NAA (20 ppm) | 188 |
| T ₄ : NAA(40 ppm) | 222 |
| T ₅ : ZnSO ₄ (0.5%) | 179 |
| T ₆ : ZnSO ₄ (1.0%) | 178 |
| T ₇ : GA ₃ (20 ppm) + ZnSO ₄ (0.5%) | 223 |
| T ₈ : GA ₃ (20 ppm) + ZnSO ₄ (1.0%) | 224 |
| T ₉ : GA ₃ (40 ppm) + ZnSO ₄ (0.5%) | 213 |
| T ₁₀ : GA ₃ (40 ppm) + ZnSO ₄ (1.0%) | 207 |
| T ₁₁ : NAA (20 ppm) + ZnSO ₄ (0.5%) | 218 |
| T ₁₂ : NAA (20 ppm) + ZnSO ₄ (1.0%) | 216 |
| T ₁₃ : NAA (40 ppm) + ZnSO ₄ (0.5%) | 228 |
| T ₁₄ : NAA (40 ppm) + ZnSO ₄ (1.0%) | 226 |
| T ₁₅ : Control (water spray) | 176 |
| S. E. m ± | 2.348 |
| CD at 5% | 6.185 |

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