**Effect of** **Potassium Nitrate (KNO3) and Gibberellic Acid (GA3) on fruit retention and yield of mango (Mangifera indica L.) cv. Amrapali**

**ABSTRACT**

An investigation was carried-out at new nursery, Adhartal, Department of Horticulture, Jawaharlal Nehru Krishi Vishwa Vidyalaya, Jabalpur to evaluate the positive effect of foliar sprays of Potassium Nitrate (KNO3) and Gibberellic Acid (GA3) on fruit retention and yield of mango cv. Amrapali” conducted in 2023. The experimental material for the present investigation was comprised of 9 treatments withKNO3 @ 1.0%, 2.0% and GA3 @25 ppm, 50 ppm along with their combinations and water spray as control. The data obtained from a set of observations for each character were subjected to “Analysis of Variance” in Randomized Block design with three replications. The impact of various treatments on fruiting parameters, including the number of fruits, fruit weight, diameter, fruit length, pulp weight, pulp percentage, and yield per plant, was documented. The experimental results revealed that among the 9 treatmentsfoliar spray of KNO3 @2%+ GA3@ 50ppm (T8) showed best performance on fruit retention (17.53%) and yield (44.10 Kg) of mango cv. Amrapali” and the control recorded less performance for the similar characteristics.

**Keywords:** Mango,Potassium Nitrate, Gibberellic acid, Fruit Drop, Fruit Retention

**1.INTRODUCTION:**

Mango (*Mangifera indica* L.) belonging to the family Anacardiaceae, is one of the most important fruit crops in India and is referred to as the “king of fruits” because of its delicious taste, excellent flavour, and attractive fragrance. The inflorescence of mango is panicles that are grown terminally. Mango is andro-monoecious, i.e., each inflorescence bears both hermaphrodite and staminate flowers (Coetzer *et al*.,1955). In India, mango is cultivated on an area of 2.3 million hectares, with a production of 20.5 million tonnes and a productivity of 15.3 MT/ha. (Anonymous, NHB- 2021). Mango fruits are a rich source of vitamin A and a fairly good source of vitamin C. Many products can be prepared from immature green and ripened fruits. Ripe fruits are used in preparing squash, nectar, jam, jelly, custard powder, baby food, toffee, etc. among the mango cultivars Amrapali has already occupied a major area in a newly planted mango orchard in high-density planting, replacing the traditional cultivars by its dwarf stature and regular bearing in nature.

Heavy fruit drop is an important factor contributing to low fruit yield in mango orchards and sometime only 0.1% of set fruit reach maturity (Malik and Singh, 2006). There are several causes of fruit drop, including nutrient deficiency, competition between developing fruitlets, drought or lack of irrigation, unfavourable climatic conditions etc. Despite adequate flowering and initial fruit set, severe fruit drop contributes to low fruit yield in mango and causes great economic losses to the grower. Fruit drop in the initial stages is affected by low auxin content and high abscisic acid (ABA) content. Besides this natural fruit fall, young developing fruit primordia abscise before reaching maturity, indicating that senescence and abscission are independent phenomena triggered by hormonal imbalance. The plant growth regulators positively affected yield attributing properties like fruit size and fruit weight of mango. It has already been demonstrated that the efficacy and concentration of plant growth regulators in a plant species for flowering, fruit drop, and fruit retention are varied under different agro-climatic conditions (Ghosh, 2016). Various attempts have been made to increase initial fruit set using cross compatible pollinizors, deblossoming, and the application of plant growth regulators, urea and potassium nitrate (Singh Z and Singh L, 1995)

In mango, the application of KNO3 is effective twice at 1st flower bud differentiation, followed by another spray during the full bloom stage with a concentration of 1% for flowering, fruiting, yield, and quality characteristics (Dadhaniya *et al*., 2018) and many investigations used GA3 to increase fruit set percentage, induce higher fruit retention, improve yield, enhance the number of fruits per tree, exert an effect on fruit quality, and enhance fruit chemical properties because it helps to multiply and lengthen the meristem cells (Maurya and Singh, 1981). Studies have shown that foliar application of KNO3 can significantly increase fruit yield by facilitating crucial processes like photosynthesis and nutrient translocation which are vital for plant health and yield.  Keeping the above facts in view the present experiment was carried out with the objective of effect of Potassium Nitrate (KNO3) and Gibberellic Acid (GA3) on fruit retention and yield of mango cv. Amrapali.

**2.MATERIAL AND METHODS:**

 The present investigation was conducted to ascertain the effect of Potassium Nitrate (KNO3) and Gibberellic Acid (GA3) on fruit retention and yield of mango (*Mangifera indica* L.) cv. Amrapali at new nursery, Adhartal, Department of Horticulture, Jawaharlal Nehru Krishi Vishwa Vidyalaya, Jabalpur with nine treatments.

The experiment was laid out in Randomized Block design in three replications with the foliar sprays of KNO3 at two different concentrations i.e., 1%, 2%and GA3 at two different concentrations i.e., 25 ppm and 50 ppm and their combinations along with spray of water as a control. solutions were prepared in water after dissolving them in the required amount of alcohol.

Spraying of chemicals & growth regulators was done with a power sprayer **on 18-year-old mango plants which are at 5mX5m spacing**. **The** treatments were given as pre-harvest sprays on fruits two times. First spray at the pea stage was done on march 15th 2023 and second spray at the marble stage was done on April 10th 2023. The fruit sampling for different parameters in randomly selected plants at each treatment was done on 28th may 2023. The observations were recorded from 5 randomly selected plants in each treatment and analysed using the OPSTAT statistical package. The percentage of fruit drop was calculated from the tagged ten panicles, which were used for fruit set counting. The percentage of fruit dropped was worked out using the following formula:

$$fruit drop \left(\%\right)at pea stage=\frac{Initial fruit set-Fruits at pea stage}{Total number of initial fruit }× 100$$

The number of fruits was counted, and the percentage of fruit retention was calculated by the following equation.

$$ Final fruit retention\left(\%\right)=\frac{Retained mature fruits}{Total number of initial fruit }× 100$$

**3.RESULTS AND DISCUSSION:**

The significance and analysis of variance of data pertaining to various criteria used for treatments were evaluated statistically. The analysis of variance of these data has been made on a mean basis, highlighting the significant effect of treatments. The results for all the treatments are presented in the succeeding paragraphs.

**3.1 Fruit drop (%) at pre-harvest sage**

The data presented in Table 1 revealed that different levels of KNO3 and GA3 treatments significantly affected the fruit drop percentage, and it varies from 80.51% to 91.74. The minimum fruit drop (80.51%) was noted in the KNO3 @2% + GA3@ 50ppm (T8) followed by 83.43% in T6 and 84.13% in T5 which showed a significant effect on the fruit drop percentage. A significant maximum fruit drop (91.74 %) was observed in T9 (control). The reduction in fruit drop percentage is linked to increased endogenous metabolite levels in the plant system. Gibberellic acid stimulates the production of a greater number of flowers, accompanied by the swift elongation of the peduncle. This sequence of events leads to the full development of flower buds, ensuring the functionality of all reproductive components. As a result, there is an improvement in the fruit set and retention, ultimately reducing the fruit drop. The results are consistent with the discoveries of Tripathi and Kumar (2022) in Mango.

**3.2 Final fruit retention (%)**

The data depicted in Table 1 indicated that KNO3, GA3, and its combination maximize the fruit retention percentage at the pre-harvest stage. The data range from 17.53 to 9.76%. the maximum fruit retention (17.53) was recorded with T8 which was significantly at par with T6, T7, T4 and T5 *i.e.*, (17.17%, 16.96%, 16.70 and 16.46% respectively). The minimum fruit retention (8.71%) was recorded with control (T9). Combining KNO3 and GA3 can have a stronger impact on fruit retention by promoting healthy growth, minimizing abscission, and enhancing nutrient transport. The results of current study are in conformity with Tripathi *et al*. (2018) in Aonla and Singh *et al.* (2023) in mango.

**Table 1: Effect of Potassium Nitrate (KNO3) and Gibberellic Acid (GA3) on fruit drop (%), fruit retention (%) of mango cv. Amrapali**

|  |  |  |  |
| --- | --- | --- | --- |
| **Notation** | **Treatment** | **Fruit Drop****(%)** | **Fruit Retention (%)** |
| T1 | KNO3 @1% | 88.28 | 13.85 |
| T2 | KNO3 @2% | 87.34 | 13.54 |
| T3 | GA3@ 25ppm | 87.17 | 15.93 |
| T4 | GA3@ 50ppm | 87.74 | 16.70 |
| T5 | KNO3 @1% + GA3@ 25ppm | 84.13 | 16.46 |
| T6 | KNO3 @2% + GA3@ 25ppm | 83.43 | 17.17 |
| T7 | KNO3 @1% + GA3@ 50ppm | 84.33 | 16.96 |
| T8 | KNO3 @2% + GA3@ 50ppm | 80.51 | 17.53 |
| T9 | Control (Water Spray) | 91.74 | 9.76 |
|  | **SEm±** | 3.26 | 1.12 |
|  | **C.D. at 5%** | 9.79 | 3.37 |

**3.3 Fruit weight (g)**

Data in Table 2 showed that foliar spray of KNO3 and GA3 significantly influenced fruit weight (g) and the maximum (212.29 g) was found in the treatment T8, which is on par with T7 (205.02g), and the minimum (166.50g) was found in the treatment T9. The most plausible explanation is that the external application of GA3 increases the mesocarp's cell size, which accelerates the growth and size of the fruit. By relaxing cell walls and enlarging vacuoles, GA3 encourages cell plasticity, which results in cell elongation. This result is consistent with the findings of Vishwakarma *et al*. (2022) and Kundu *et al.* (2023)

**3.4 Fruit diameter (cm) and fruit length (cm)**

The data in Table 2 showed that foliar feeding of KNO3, GA3 and its combination influenced fruit diameter and fruit length, with the maximum fruit diameter (6.19cm) found in the treatment T8, which is on par with T7 (5.92 cm) and T5 (5.76 cm) and T6 (5.73 cm) and the minimum (4.93 cm) found in the treatment T9. Maximum fruit length (11.41) found in the treatment T8, which is on par with T7 (10.19), and the minimum (8.88) was found in the treatment T9. The significant effect of combination of KNO3 and GA3 applied may be due to the effect of the accelerated movement of photosynthates, the sugars made by leaves to the developing fruits could potentially leading to better growth and reduced chances of falling off. These findings agree with Bhowmick and Banik (2011) in Mango.

**Table 2: Effect of Potassium Nitrate (KNO3) and Gibberellic Acid (GA3) on fruit weight (g), fruit length (cm) and fruit diameter (cm) of mango *cv.* Amrapali**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **S.No** | **Treatment** | **Fruit Weight (g)** | **Fruit Length****(cm)** | **Fruit Diameter****(cm)** |
| T1 | KNO3 @1% | 174.94 | 8.37 | 5.31 |
|  T2 | KNO3 @2% | 177.22 | 8.92 | 5.26 |
| T3 | GA3@ 25ppm | 178.05 | 9.28 | 5.76 |
| T4 | GA3@ 50ppm | 184.66 | 9.50 | 5.63 |
| T5 | KNO3 @1% + GA3@ 25ppm | 181.07 | 9.72 | 5.76 |
| T6 | KNO3 @2% + GA3@ 25ppm | 197.90 | 9.94 | 5.73 |
| T7 | KNO3 @1% + GA3@ 50ppm | 205.02 | 10.19 | 5.92 |
| T8 | KNO3 @2% + GA3@ 50ppm | 212.29 | 11.41 | 6.19 |
|  T9 | Control (Water Spray) | 166.50 | 8.88 | 4.93 |
|  | **SEm±** | 6.57 | 0.39 | 0.20 |
|  | **C.D. at 5%** | 19.72 | 1.19 | 0.61 |

**3.3 Stone weight (g)**

The data recorded on average stone weight are presented in Fig. 1. The data revealed that the average stone weight ranged from 30.64 g to 35.35 g under different treatments. The minimum stone weight of 30.64 g was recorded under the treatment (T8) which was found significantly at par with T6 (31.32 g), T7 (31.59 g), and T5 (32.30 g) While, the maximum stone weight (35.35 g) was recorded under control (T9). The decrease in the weight of stone can be accompanied with increase in pulp weight which is more economically desired. The possible reason of this could be the transfer of photosynthates to the new emerging leaves with the application of GA3 and KNO3. These findings agree with Maurya *et al.* (2020).

 **3.4 Peel weight (g)**

Data related to peel weight are represented in Fig 1 revealed that the minimum peel weight of fruit 27.13 g under (T8) was recorded and found significantly at par with T7 (28.55g) and the maximum peel weight (35.38g) was recorded under control (T9). The decrease in peel weight is associated with increase in the pulp percent and pulp weight. These results were supported with the findings of Maurya *et al* (2020) Tripathi and Kumar (2022) in mango.

 **3.5 Pulp weight (g)**

The perusal data related to pulp weight of fruit was significantly influenced by all the treatments and data are depicted in Fig.1. The data revealed that the maximum pulp weight (154.19g) was recorded with treatment T8 which was significantly at par with T7 (144.87g). Whereas the lowest pulp weight (95.76 g) was recorded under T9 (control). KNO3 and GA3 increase fruit pulp due to potassium's essential role in plant growth, cell expansion, water uptake, and nutrient transport, contributing to well-formed, pulpy fruit. According to Maurya *et al,* (2020) using GA3 led to increased fruit pulp weight while reducing peel and stone quantities. This success can be attributed to enhanced leaf-to-fruit transportation of photosynthates, which allows for more efficient use of resources. These results align with the observation of Singh *et al.* (2023).

**3.6 Number of fruits per plant**

Data in Table 3 and Fig. 2 showed that foliar application of nutrients was significantly influenced by the number of fruits per plant and the maximum (221.38) was found in the treatment T8, at par with T7 (212.07), T6 (208.81), and the minimum (170.38) was found in the treatment T9. The application of PGR and Potassium nitrate improved the no. of fruit per tree by improving retention and decrease the fruit drop. These results were similar to the studies of Abd El-Rhman *et al.* (2017).

**3.7 Yield per plant (kg)**

The yield per plant (kg) of mango plants was dramatically impacted by the use of various combinations of KNO3 and GA3. Data in Table 3 and Fig. 2 showed that nutrient strategies significantly influenced yield per plant and the maximum (44.10 kg) was found in the treatment T8, which is on par with T7 (43.48kg), and the minimum (28.33kg) was found in treatment T9. An extended flowering period, improved fruit set, increased fruit set per panicle, prevention of abscission in young fruits, a higher number of fruits per tree, improved fruit retention, and optimal use of nutritional resources within the trees may all contribute to the increased yield seen in trees treated with GA3 and potassium nitrate. All these elements work together to raise fruit output overall. These results are similar to findings of Bhowmick and Banik (2011) and Parauha and Pandey (2019).

**Table 3: Effect of Potassium Nitrate (KNO3) and Gibberellic Acid (GA3) on number of fruit and fruit yield (kg/tree) mango cv. Amrapali**

|  |  |  |  |
| --- | --- | --- | --- |
| **S.No** | **Treatment** | **Number of Fruit per plant**  | **Fruit Yield (Kg/tree)** |
| T1 | KNO3 @1% | 177.45 | 31.00 |
| T2 | KNO3 @2% | 182.67 | 32.36 |
| T3 | GA3@ 25ppm | 197.43 | 35.23 |
| T4 | GA3@ 50ppm | 203.10 | 37.40 |
| T5 | KNO3 @1% + GA3@ 25ppm |  208.30 | 41.19 |
| T6 | KNO3 @2% + GA3@ 25ppm | 208.81 | 41.31 |
| T7 | KNO3 @1% + GA3@ 50ppm | 212.07 | 43.48 |
| T8 | KNO3 @2% + GA3@ 50ppm | 221.38 | 44.10 |
| T9 | Control (Water Spray) | 170.38 | 28.33 |
|  | **SEm±** | 7.04 | 1.38 |
|  | **C.D. at 5%** | 21.12 | 4.13 |

**4. CONCLUSION:**

In conclusion, the treatment KNO3 @ 2% + GA3@ 50ppm proved superiority in improving the fruit retention and yield of fruits regarding high fruit retention percentage, number of fruits per plant with maximum fruit length, diameter and fruit yield per plant. However, fruit drop percentage was lowest in fruits produced by trees sprayed with KNO3 @ 2% + GA3@ 50ppm indicating improved fruit-setting and overall yield stability over the control and other treatments.

**5. DISCLAIMER (ARTIFICIAL INTELLIGENCE):**

Author(s) hereby declare that NO generative AI technologies such as Large Language Models (ChatGPT, COPILOT, etc.) and text-to-image generators have been used during the writing or editing of this manuscript.

**6. COMPETING INTERESTS:**

Authors have declared that they have no known competing financial interests OR non-financial interests OR personal relationships that could have appeared to influence the work reported in this paper.

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