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## Effect of foliar application of micronutrients and plant growth regulators on yield of winter-season guava (*Psidium guajava* L.) cv. L-49

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### Abstract

The experiment was conducted at the Main Experiment Station at Akma, Department of Horticulture, Narendra Deva University of Agriculture and Technology, Narendra Nagar, Kumarganj, Faizabad (U.P.) during the year 2015-16. The experiments were conducted in Randomized Block Design (RBD) with nine treatments, replicated three times, considering one plant as a unit. The observations were recorded for fruit set, fruit yield, and physico-chemical attributes of guava fruits. The maximum fruit set, fruit retention, number of fruits and fruit yield were recorded with foliar application of Borax 0.5% + GA<sub>3</sub> 100 ppm, closely followed by Borax 0.5% + NAA 100 ppm. Based on the present findings, it can be concluded that the foliar application of Borax 0.5% + GA<sub>3</sub> 100 ppm, followed by Borax 0.5% + NAA 100 ppm, also gave the best result for the production of higher fruit yield.

**Keywords:** Guava, GA<sub>3</sub>, Micronutrient, Plant Growth Regulators, Yield

### Introduction

Guava (*Psidium guajava* L.) is one of the most important tropical and sub-tropical fruit of India, belonging to the family Myrtaceae. It originated in Tropical America, perhaps from Mexico to Peru and was introduced in India by the Portuguese. It is also known as apple of the tropics. Guava is commercially grown throughout the country, particularly in Uttar Pradesh, Maharashtra, Bihar, Orissa, Punjab, Uttarakhand, Gujarat, Madhya Pradesh and West Bengal. Uttar Pradesh is considered the most important guava-producing state of India, in which Allahabad region has the reputation of growing the best quality guava in the country as well as all over the world. Guava covers an area of 268.2 lakh ha in India. Uttar Pradesh leads in production, while the Allahabad region of UP produces the highest-quality guava in India and around the world, has largest area, covering about 45.1 lac ha. followed by Bihar, 30.0 lac ha. The productivity is higher in Madhya Pradesh. i.e. 32 ton/ha. It covers around 3.3% (2680000 ha) of the total area under fruit crop and contributes 3.3% (3668000 MT) of total fruit production (Anonymous 2013-14).

Guava is a shrub or small tree 3-6 m in height and the fruit is medium, deep scarlet in colour, mainly globose in shape. In northern India, including Uttar Pradesh, there are two flowering seasons of guava i.e., April-May for the rainy season crop and August-September for the winter season crop. Heavy flowering occurs during the summer season (Singh *et al.*, 1983).

The guava bears flowers and fruits on current season growing twigs and highly cross pollinated crop and pollination occurs through Honey bees and Andrena insects. Fruits of guava develop from inferior ovary and exhibited double sigmoid growth curve. The fruit is a many-seeded berry. The fruit takes nearly 4-5 months from flowering to maturity. The colour of the fruit changes on maturity from dark green to yellowish green. The growth regulators and nutrients play a vital role in the growth and development of fruit trees. The foliar application of growth regulators and nutrients is comparatively more effective for rapid recovery of plants. Foliar application of micronutrients and plant growth regulators have been found very effective in manipulating cropping season, improving fruit set and fruit retention of guava fruits.

### Materials and methods

The present investigation entitled "Effect of foliar application of micronutrients and plant

growth regulators on yield and quality of winter season guava (*Psidium guajava* L.) cv.L-49.” was carried out at the Main Experiment Station at Akma, Department of Horticulture, Narendra Deva University of Agriculture and Technology, Kumarganj, Faizabad (U.P.) during the year 2015-16. The plants were planted using a Randomized Block Design (RBD) at a distance of 6 x 6 meters. There were three replications and nine treatments. Three plants were kept in each treatment, for a total of twenty-seven plants throughout the trial. The details of the materials used and methods employed in the experimental work are elaborated as under headings and sub-headings:

### 2.1 Experimental site and climatic conditions

The experiment was carried out under sodic soil condition and experimental site was located at the Main Experiment Station at Akma, Department of Horticulture, Narendra Deva University of Agriculture & Technology, Kumarganj, Faizabad, on the Raebareli Road at a distance of 42 Km. from Faizabad district headquarters. Geographically, it is situated 26.47 °N latitude and 80.12°E longitude at an altitude of 113 meters above mean sea level. The site is located in typical saline-alkaline soils of the Indo-Gangetic plains of eastern Uttar Pradesh.

### Climate and meteorological conditions

The region enjoys a sub-humid and sub-tropical climate, receiving annual rainfall of about 1100 mm, out of which 85% occurs from 21 mid June to end September. The winter months are cool and dry; occasionally, frost occurs during this period. Hot winds start blowing from the month of April and continue up to the onset of monsoon. The weather data was recorded during the course of investigation at metrological observatory of Narendra Deva University of Agriculture and Technology, Kumarganj, Faizabad.

### Experimental materials

Eighteen (18) years old guava plants were selected for the investigation. Foliar application of micronutrients, plant growth regulators and other orchard management practices were applied as per recommended package and practices for guava cultivation. Manures and fertilizer were applied in each treatment before flowering in the month of July for taking winter season crop of guava.

### Experimental details

The experiment consists of 9 treatments: T<sub>1</sub> Control (water spray), T<sub>2</sub> ZnSO<sub>4</sub> @ 0.5%, T<sub>3</sub> Borax @ 0.5%, T<sub>4</sub> NAA @ 100 ppm, T<sub>5</sub> GA<sub>3</sub>@ 100 ppm, T<sub>6</sub> ZnSO<sub>4</sub> @ 0.5% + NAA @ 100 ppm, T<sub>7</sub> Borax @ 0.5% + NAA @ 100 ppm, T<sub>8</sub> ZnSO<sub>4</sub> @ 0.5% + GA<sub>3</sub> @ 100 ppm and T<sub>9</sub> Borax @ 0.5%+ GA<sub>3</sub> @ 100 ppm.

### Time of spraying

First spraying of micronutrients and plant growth regulators was done before flowering (first week of August) and second after fruit set (second week of September) during 2015-16.

## Results & Discussion

### Physical parameters:

#### Fruits set (%)

It is clear from the data of Table 1 that the foliar spray of micronutrients and GA<sub>3</sub> proved significantly effective in

improving the per cent fruit set. The maximum fruit set (64.45 per cent) was noted with foliar spray of 0.5 per cent Borax + GA<sub>3</sub> 100 ppm (T<sub>9</sub>). Followed by fruit set (55.40 per cent) with foliar spray of 0.5 per cent borax + NAA 100 ppm (T<sub>7</sub>). While the minimum fruit set (46.48 per cent) was recorded under the control treatment (T<sub>1</sub>).

#### Fruit retention (%)

Observations with respect to fruit retention of guava are presented in Table 4.1, which clearly indicated that spray of various treatments significantly influenced the percentage of fruit retention. Maximum fruit retention (56.25 per cent) was noted with foliar spray of 0.5 per cent ZnSO<sub>4</sub> + 100 ppm GA<sub>3</sub> (T<sub>9</sub>), followed by fruit retention (49.45 per cent) in T<sub>7</sub> with foliar spray of Borax 0.5% + NAA 100 ppm (T<sub>7</sub>). While minimum fruit retention (38.9 per cent) was noted under control (T<sub>1</sub>).

#### Fruit yield (kg/plant)

Fruit yield of guava cv. Lucknow-49 was significantly influenced by foliar application of various treatments during the year. The data given in Table 4.1 indicated that maximum fruit yield (67.10 kg/tree) was recorded with the foliar application of Borax 0.5% + GA<sub>3</sub> 100 ppm (T<sub>9</sub>) followed by ZnSO<sub>4</sub> 0.5% + GA<sub>3</sub> 100 ppm (T<sub>8</sub>). While minimum fruit yield (43.42 kg/tree) was recorded under control (T<sub>1</sub>). The data also indicated that the higher concentration of plant growth regulators and nutrients gave a better response to fruit yield than their lower concentrations.

#### Fruit yield (q ha<sup>-1</sup>)

Fruit yield of guava cv. Lucknow-49 was significantly influenced by the foliar application of various treatments during the year. The data given in Table 4.1 indicate that maximum fruit yield (184.93 q ha<sup>-1</sup>) was recorded with the foliar application of Borax 0.5% + GA<sub>3</sub> 100 ppm (T<sub>9</sub>) followed by ZnSO<sub>4</sub> 0.5% + NAA 100 ppm. While minimum fruit yield (119.40 q ha<sup>-1</sup>) was recorded under control (T<sub>1</sub>) during 2015. The data also indicated that the higher concentration of plant growth regulators and nutrients gave a better response to fruit yield than their lower concentrations.

#### Fruit length (cm)

It is evident from the data presented in Table 2 that all the treatments significantly increased the fruit length over control (T<sub>1</sub>). The maximum fruit lengths (7.82 cm) were measured with the foliar application of Borax 0.5% + GA<sub>3</sub> 100 ppm (T<sub>9</sub>), which was significantly superior over the rest of the treatments. However, the minimum fruit length (6.66 cm) was recorded under control (T<sub>1</sub>). The data clearly indicated that the higher concentration of micronutrients and plant growth regulators was found most effective as compared to lower concentrations during the year.

#### Fruit width (cm)

Data with respect to the effect of various micronutrients and plant growth regulators spray on width of fruit has been given in Table 2, clearly indicating the highest width of fruit (7.52 cm) was noted in treatment Borax 0.5% + GA<sub>3</sub> 100 ppm (T<sub>9</sub>), which was found significantly superior over the rest of the treatments. However, the minimum width of fruit (6.45 cm) was observed under control (T<sub>1</sub>). The higher concentration of micronutrients and plant growth regulators gave a more pronounced effect on the width of guava fruit

as compared to their lower concentrations.

### Fruit weight (g)

The data on fruit weight were given in Table 2, clearly indicating that the foliar feeding of micronutrients and plant growth regulators increased the fruit weight markedly over the control ( $T_1$ ). The highest fruit weight (153 g) was recorded with the foliar application of Borax 0.5% +  $GA_3$  100 ppm ( $T_9$ ), closely followed by Borax 0.5% + NAA 100 ppm ( $T_7$ ), which was found significantly effective over the rest of the treatments. However, the lowest fruit weight (111.8 g) was observed in the control ( $T_1$ ). The higher fruit weight was observed with the foliar application of higher concentrations of micronutrients and plant growth regulators, improving the weight of fruit in guava as compared to lower concentrations.

### Fruit volume ( $cm^3$ )

The data regarding fruit volume were presented in Table 4.2, which revealed that foliar application of all the

treatments increased fruit volume significantly over control ( $T_1$ ). The critical observation of the data showed that maximum fruit volume ( $cm^3$ ) was measured in treatment Borax 0.5% +  $GA_3$  100 ppm ( $T_9$ ), followed by  $ZnSO_4$  0.5% + NAA 100 ppm ( $T_6$ ), while the minimum fruit volume (101.75) was recorded under control ( $T_1$ ).

### Specific gravity of fruit

The data pertaining to specific gravity of guava were presented in Table 2, which clearly indicated that the foliar application of growth regulators and nutrients significantly increased specific gravity of guava fruit over control ( $T_1$ ). The critical observation of the data showed that maximum specific gravity (1.11) was found in treatment Borax 0.5% +  $GA_3$  100 ppm ( $T_9$ ), which was found at par with  $ZnSO_4$  0.5% ( $T_2$ ) and ( $T_3$ ) Borax 0.5%, significantly superior over the rest of the treatments. However, the minimum specific gravity was noticed in control ( $T_1$ ) i.e., (1.09).

## Tables and Figures

**Table 1:** Effect of foliar application of micronutrients and plant growth regulators on growth and yield of guava.

| Treatment                                | Fruit setting (%) | Fruit retention (%) | Fruit yield (kg/plant) | Fruit yield ( $q\ ha^{-1}$ ) |
|------------------------------------------|-------------------|---------------------|------------------------|------------------------------|
| $T_1$ : Control                          | 46.48             | 38.9                | 43.42                  | 119.41                       |
| $T_2$ : $ZnSO_4$ 0.5%                    | 57.88             | 48                  | 56.055                 | 154.15                       |
| $T_3$ : Borax 0.5%                       | 61.77             | 52.05               | 61.385                 | 168.81                       |
| $T_4$ : NAA @ 100 ppm                    | 54.34             | 48.15               | 46.058                 | 126.66                       |
| $T_5$ : $GA_3$ @ 100 ppm                 | 50.55             | 48.65               | 49.1                   | 135.03                       |
| $T_6$ : $ZnSO_4$ 0.5% + NAA @ 100 ppm    | 59.55             | 49.1                | 56.965                 | 156.65                       |
| $T_7$ : Borax 0.5% + NAA @ 100 ppm       | 55.4              | 49.45               | 49.165                 | 135.20                       |
| $T_8$ : $ZnSO_4$ 0.5% + $GA_3$ @ 100 ppm | 60.5              | 52.25               | 60.28                  | 165.77                       |
| $T_9$ : Borax 0.5% + $GA_3$ @ 100 ppm    | 64.45             | 56.25               | 67.105                 | 184.54                       |
| S.E.m. $\pm$                             | 2.271             | 2.110               | 2.251                  | 6.98                         |
| C.D. at 5%                               | 6.809             | 6.324               | 6.748                  | 20.94                        |

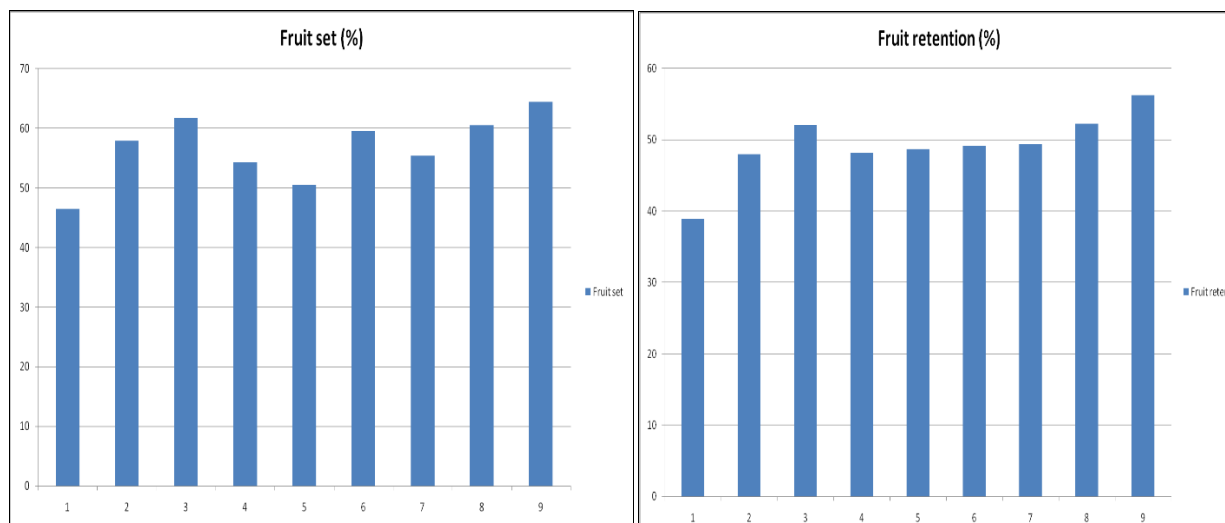


**Fig 1:** Effect of foliar application of micronutrients and plant growth regulators on fruit set and fruit retention of guava

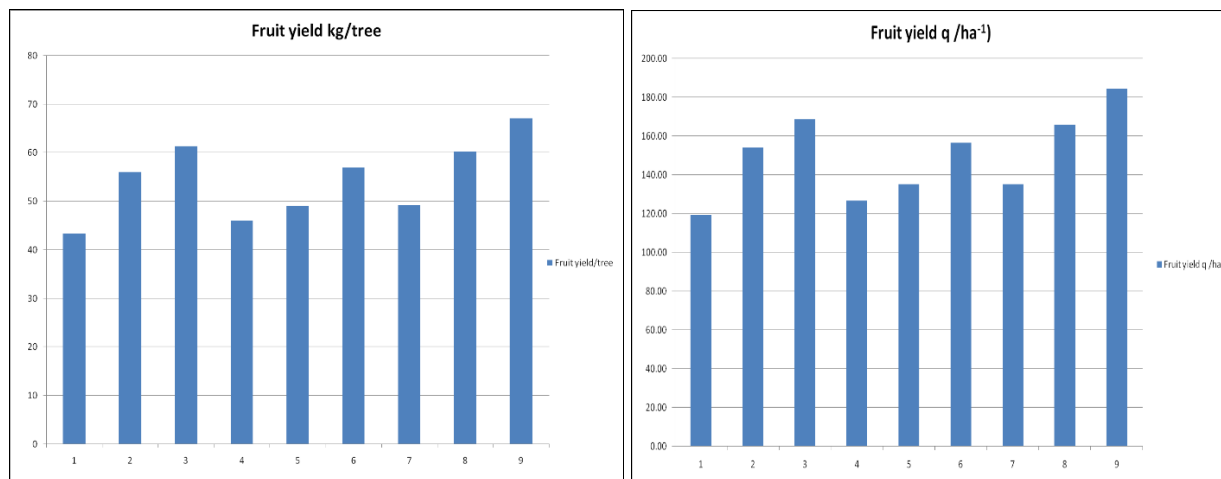


**Fig 2:** Effect of foliar application of micronutrients and plant growth regulators on fruit yield (kg/tree) and fruit yield (q/ha) retention of guava

**Table 2:** Effect of foliar application of micronutrients and plant growth regulators on growth and yield of guava

| Treatment                                                           | Fruit length (cm) | Fruit width (cm) | Fruit weight (g) | Fruit volume (cm <sup>3</sup> ) | Specific gravity |
|---------------------------------------------------------------------|-------------------|------------------|------------------|---------------------------------|------------------|
| T <sub>1</sub> : Control                                            | 6.66              | 6.45             | 111.8            | 101.75                          | 1.10             |
| T <sub>2</sub> : ZnSO <sub>4</sub> 0.5%                             | 7.2               | 6.86             | 131.9            | 118.47                          | 1.11             |
| T <sub>3</sub> : Borax 0.5%                                         | 6.57              | 7.3              | 143.9            | 129.25                          | 1.11             |
| T <sub>4</sub> : NAA @ 100 ppm                                      | 7.2               | 7.05             | 128.7            | 113.465                         | 1.13             |
| T <sub>5</sub> : GA <sub>3</sub> @ 100 ppm                          | 7.4               | 7.3              | 137              | 125.29                          | 1.09             |
| T <sub>6</sub> : ZnSO <sub>4</sub> 0.5% + NAA @ 100 ppm             | 7.47              | 7.05             | 138.8            | 127.325                         | 1.09             |
| T <sub>7</sub> : Borax 0.5% + NAA @ 100 ppm                         | 7.28              | 7.12             | 133.25           | 123.915                         | 1.08             |
| T <sub>8</sub> : ZnSO <sub>4</sub> 0.5% + GA <sub>3</sub> @ 100 ppm | 7.62              | 7.3              | 142.1            | 128.7                           | 1.10             |
| T <sub>9</sub> : Borax 0.5% + GA <sub>3</sub> @ 100 ppm             | 7.82              | 7.52             | 153              | 137.28                          | 1.11             |
| S.Em. ±                                                             | 0.246             | 0.152            | 5.341            | 2.937                           | 0.017            |
| C.D. at 5%                                                          | 0.737             | 0.455            | 16.013           | 8.805                           | 0.050            |

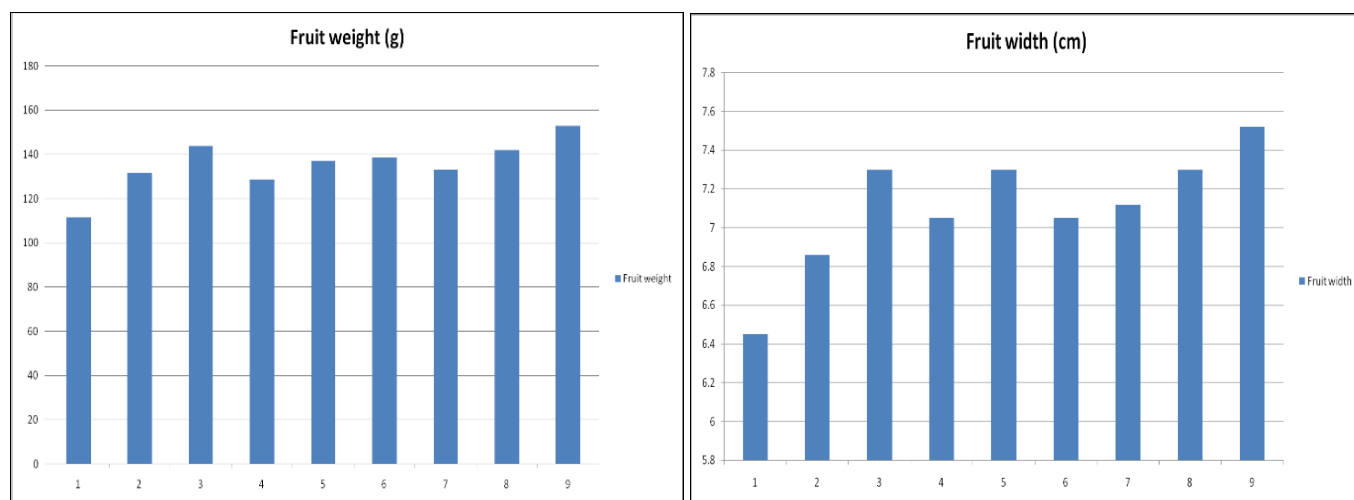


**Fig 3:** Effect of foliar application of micronutrients and plant growth regulators on fruit length and width of guava

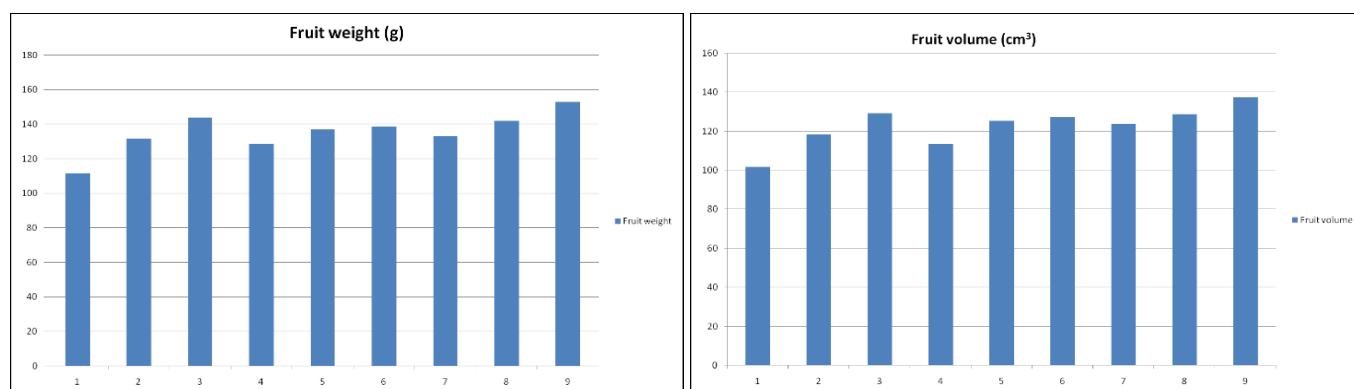


**Fig 4:** Effect of foliar application of micronutrients and plant growth regulators on fruit weight and volume of guava

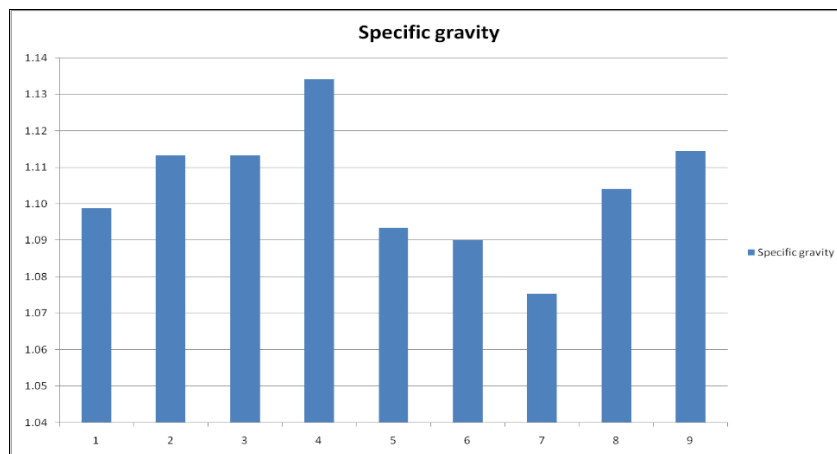


**Fig 5:** Effect of foliar application of micronutrients and plant growth regulators on fruit specific gravity of guava

### Conclusion

The present investigation on the effect of foliar application of micronutrients and plant growth regulators on winter-season guava cv. *Lucknow-49* revealed that all treatments significantly improved growth and yield compared to the control. Among all treatments, the combined application of Borax 0.5% + GA<sub>3</sub> 100 ppm proved to be the most effective. This treatment recorded the highest fruit set, fruit retention, number of fruits per tree and fruit yield. It also produced larger fruits with greater length, width, weight, volume and specific gravity. The treatment Borax 0.5% + NAA 100 ppm was the next best treatment for most of the parameters studied. Therefore, foliar application of Borax 0.5% + GA<sub>3</sub> 100 ppm can be recommended for improving the growth and yield of winter-season guava (*Psidium guajava* L.) cv. *Lucknow-49* under the agro-climatic conditions of Uttar Pradesh.

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