



# Effect of different levels of micronutrients on vegetative growth, yield and fruit quality of Mango (*Mangifera indica* L.)

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## Summary

An experiment was carried out to ascertain the impact of foliar application of certain micronutrients on fruit yield and quality of Mango (*Mangifera indica* L.) cultivars "Dashehari" and "Langra" at Agriculture Research Station, Banswara, Maharana Pratap University of Agriculture and Technology, Udaipur, Rajasthan, during the year 2016-17 on seventeen years old mango trees. The experiment was laid out in One way ANOVA (Randomized Block Design) with eight treatments in thrice replications for combinations with different micronutrients Zinc sulphate, Copper sulphate, Borax, boric acid and IIHR-2 mango special were applied on mango cultivars "Dashehari" and "Langra" at different growth stages. All were fertilized with a recommended dose of NPK (1500:500:1000 g as N, P<sub>2</sub>O<sub>5</sub> and K<sub>2</sub>O). The spraying was done twice; during mid-October, mid-December, and mid-February before the flowering stage and again in mid-March at the marble stage during both years of study. Foliar sprays, in general, improved fruit yield. Yields were exceptionally higher in response to foliar application of Zinc (Zn), Copper (Cu) and boron (B) compared to other treatments. Result proved that foliar application of mango trees with [(RDF + Zinc sulphate (100 g) + Copper sulphate (50 g) + Boric acid (50 g) as soil + Zinc sulphate (0.2%) + Copper sulphate (0.1%) + Boric acid (0.1%) as foliar (Two sprays before flowering and marble stage)] was the promising treatment for improvement of vegetative growth, yield and fruit quality. This treatment was also found best for maximum total carotenoids, average fruit weight as well as fruit yield.

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**Keywords:** Mango, Dashehari, Langra, foliar spray, micronutrient, vegetative growth, Physical quality parameters, yield.

## Introduction

Mango (*Mangifera indica* L.) is an important fruit in the tropical and sub-tropical regions and belongs to the family Anacardiaceae in the order Sapindales. Mango is an important fruit crop in India and is popularly called the 'king of fruits'. Mango is one of the most important fruits of India occupying 35.4 per cent of the total area under the fruits however; it accounted for 21.4 per cent of the total production of fruits in 2014-15. India is the largest producer of mango in the world. The crop covers an area of 2.51 million hectares with an annual production of approximately 18.43 million tonnes, contributing more than 62.2 % share of the world production FAO (5).

In India, Uttar Pradesh is the leading mango-producing state, occupying an area of 2.62 lakh ha, with a production of 4300.98 thousand MT with a productivity of 16.4 MT ha<sup>-1</sup> Anonymous, (4). In the case of Rajasthan, major mango-growing pockets are Chittorgarh, Banswara, Udaipur and Dungarpur districts. Micro-nutrients such as iron, zinc and boron are essential for different biological functions that might be attributed to tree yield and fruit quality. Singh and Rajput (14) observed increased fruit yield, fruit sugars and ascorbic

acid in mango cv. Chausa with the treatment of the highest ZnSO<sub>4</sub> application rate. Rath *et al.* (8) applied zinc or boron each at the rate of 0.2-0.8 per cent on 13-year-old mango cv. Langra trees at full bloom stage and found the tremendous enhancement in total sugars, TSS and ascorbic acid of fruit at higher rates of boron or zinc. It also increases resistance to disease and insect pests and improves drought tolerance Tariq *et al.* (15). Boron is another important micronutrient which is deficient in our soils and adversely affects the yield and quality Imtiaz *et al.* (6). Zinc plays an important role in the chlorophyll biosynthesis pathway. balanced application and uptake of K, Ca and B can improve the quality and yield of mango trees. So, a field study was conducted with the hypothesis that the combined application of K and Ca along with B would be effective in improving the yield and quality of Mango cv. Summer Bahisht Chaunsa Ahmad *et al.* (1). Application of boron increases fruit setting and yield as well as quality by increasing total soluble solids (TSS) and total sugars (Ruby *et al.* (9). Combined soil application of B and Zn resulted in optimum increases in leaf mineral B and Zn and fruit-set, retention, yield, pulp recovery and total soluble solids at ripening stage. Additionally, this combined application improved fruit quality viz. taste, flavour, texture, and aroma Ahmad *et al.* (1). Boron proves to have a major role in increasing leaf C/N ratio and mango fruit yield. Boron application showed a beneficial effect on improving fruit quality (e.g.

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improving colouration, increasing TSS, sugars and vitamin C and reducing acidity). Fruit yield is highly correlated with boron concentration Shaban et al. (11) and Anusuya et al. (18). There is a need to standardize dose of agrochemicals and micronutrients for uniform flowering, higher yield and quality under Rajasthan Conditions. However, there is limited work done on the effect of micronutrient spray on mango cultivars. Mangoes have the ability to catch the market when there is no fruit available in the market. Therefore, it is necessary to evaluate the effect of different levels of micronutrient application on mango cultivars "Dashehari" and "Langra" under sub-humid conditions in Rajasthan.

### Materials and Methods

The experiment was carried out on seventeen-year-old uniform mango trees planted 10 x 10 metre spacing. The experimental mango orchard is located in the Humid Southern Plain Agroclimatic Zone (IV-B) at Agricultural Research, Station, Banswara. The experiment was laid out in One way ANOVA (Factorial Randomized Block) Design with eight treatment in thrice replications for combinations with T<sub>1</sub>- Control, T<sub>2</sub>- RDF + Zinc sulphate (200 g) + Boric acid (100 g) as soil, T<sub>3</sub>- RDF + Zinc sulphate (200 g) + Copper sulphate (100 g) + Borax (100 g) as soil, T<sub>4</sub>- RDF + Zinc sulphate (0.4%) + Boric acid (0.2%) [2 sprays at just before flowering and marble stage], T<sub>5</sub>- RDF + Zinc sulphate (0.4%) + Copper sulphate (0.2%) + Borax (0.2%) [2 sprays before flowering and marble stage], T<sub>6</sub>- RDF + Zinc sulphate (100 g) + Copper sulphate (50 g) + Boric acid (50 g) (Soil application) + Zinc sulphate (0.2%) + Boric acid (0.1%) as foliar (2 sprays before flowering and marble stage), T<sub>7</sub>- RDF + Zinc sulphate (100 g) + Copper sulphate (50 g) + Boric acid (50 g) as soil + Zinc sulphate (0.2%) + Copper sulphate (0.1%) + Boric acid (0.1%) as foliar (2 sprays before flowering and marble stage), T<sub>8</sub>- RDF + Mango special (IIHR) 2 spray before flowering and marble stage, V<sub>1</sub>- Dashehari, V<sub>2</sub>- Langra. All the trees were fertilized with a recommended dose of NPK (1500:500:1000 g as N, P<sub>2</sub>O<sub>5</sub> and K<sub>2</sub>O). The spraying was done twice; during mid-October, mid-December, and mid-February before the flowering stage and again in mid-March at the marble stage during both years of study. The study was laid out with 7 treatments in involved a factorial randomised block design with replicated thrice. There were three homogenous trees per elemental plot.

The variables evaluated were a number of flowers/ ten tagged panicles, flowering intensity, per cent hermaphrodite flowers, per cent fruit set, least length and width of panicle, fruit weight, yield kg/tree, yield t/ha in the year after treatment application. The final shoot length was evaluated in winter. A randomly selected sample of was recorded on 100 tagged shoots (25 shoots in each direction) and the average was calculated at 90 and 180 days after treatment application. Data were analyzed with significant variation at the 5% level of significance in different parameters/attributes studied under investigation using OPSTAT- CCSHAU, Hisar software, Sheoran et al. (12).

### Results and Discussion

The response of micronutrients on vegetative shoot emergence at 90 and 180 days after treatment application was significantly higher during both years of studies. The micronutrients (Zinc sulphate, Boric acid, Copper sulphate and Borax) significantly increased the vegetative growth characteristics of mango cultivars Dashehari and Langra. The pooled data indicated that maximum shoot length and canopy volume (23.79, 26.51 cm and 203.50 m<sup>3</sup>) were recorded in Dashehari (V<sub>1</sub>) at 90 and 180 days after treatment application respectively and minimum in cv. Langra (V<sub>2</sub>). The treatment effect on vegetative shoot length (23.88 and 27.78 cm) was maximum in T<sub>8</sub> (Mango special IIHR, 2 sprays before flowering and marble stage), which was statistically at par with T<sub>6</sub> and T<sub>7</sub>. In reference to interaction, the effect of micronutrients and both the mango cultivars showed significant variations and noted maximum canopy volume 241.98 m<sup>3</sup> in V<sub>1</sub>T<sub>8</sub> (Dashehari + Mango special IIHR, 2 spray before flowering and marble stage). Leaf area had a significant effect on both the cultivars, while Langra showed higher leaf expansion (72.96 cm<sup>2</sup>) as compared to Dashehari the least leaf expansion (69.45 cm<sup>2</sup>). The maximum vegetative growth parameters were recorded with the application of T<sub>8</sub> (Mango special, IIHR) 2 sprays before flowering and marble stage, followed by T<sub>7</sub> [(RDF + Zinc sulphate (100 g) + Copper sulphate (50 g) + Boric acid (50 g) as soil + Zinc sulphate (0.2%) + Copper sulphate (0.1%) + Boric acid (0.1%) as foliar; 2 sprays before flowering and marble stage)]. The interaction level V<sub>2</sub>T<sub>8</sub> (Langra + Mango special IIHR, 2 sprays before flowering and marble stage) resulted in maximum leaf area (76.90 cm<sup>2</sup>).

**Table 1. Response of mango cultivars to micronutrients on vegetative growth parameters**

| Treatments/<br>Cultivars   | Shoot length (cm) |         | Canopy volume<br>(m <sup>3</sup> ) | Leaf area<br>(cm <sup>2</sup> ) |
|----------------------------|-------------------|---------|------------------------------------|---------------------------------|
|                            | 90 DAT            | 180 DAT |                                    |                                 |
| V <sub>1</sub> : Dashehari | 23.79             | 26.51   | 203.50                             | 69.45                           |
| V <sub>2</sub> : Langra    | 19.29             | 25.78   | 194.66                             | 72.96                           |
| SEm±                       | 0.34              | 0.33    | 3.00                               | 0.67                            |
| C.D.5%                     | 0.96              | NS      | 8.49                               | 1.88                            |
| Micro nutrients            |                   |         |                                    |                                 |
| T <sub>1</sub>             | 19.63             | 23.77   | 172.79                             | 69.76                           |
| T <sub>2</sub>             | 19.91             | 25.39   | 185.96                             | 70.33                           |
| T <sub>3</sub>             | 20.32             | 25.85   | 191.69                             | 70.65                           |
| T <sub>4</sub>             | 21.32             | 26.28   | 196.18                             | 69.87                           |
| T <sub>5</sub>             | 21.81             | 26.43   | 202.58                             | 70.94                           |
| T <sub>6</sub>             | 22.36             | 26.73   | 205.27                             | 71.07                           |

|                |       |       |        |       |
|----------------|-------|-------|--------|-------|
| T <sub>7</sub> | 23.10 | 26.92 | 216.61 | 71.84 |
| T <sub>8</sub> | 23.88 | 27.78 | 221.56 | 75.18 |
| SEm±           | 0.68  | 0.66  | 6.00   | 1.33  |
| CD at 5%       | 1.91  | 1.86  | 16.98  | NS    |
| CV (%)         | 10.86 | 8.72  | 10.45  | 6.48  |

**Table 2.** Interaction effect of mango cultivars to micro nutrients on vegetative growth parameters

| Treatments                    | Shoot length (cm) |         | Canopy volume (m <sup>3</sup> ) | Leaf area (cm <sup>2</sup> ) |
|-------------------------------|-------------------|---------|---------------------------------|------------------------------|
|                               | 90 DAT            | 180 DAT |                                 |                              |
| V <sub>1</sub> T <sub>1</sub> | 22.23             | 25.12   | 164.80                          | 68.23                        |
| V <sub>1</sub> T <sub>2</sub> | 22.47             | 25.88   | 182.47                          | 68.71                        |
| V <sub>1</sub> T <sub>3</sub> | 22.99             | 26.31   | 188.09                          | 68.87                        |
| V <sub>1</sub> T <sub>4</sub> | 23.96             | 26.41   | 195.97                          | 67.32                        |
| V <sub>1</sub> T <sub>5</sub> | 24.19             | 26.57   | 207.89                          | 69.30                        |
| V <sub>1</sub> T <sub>6</sub> | 24.43             | 26.78   | 212.77                          | 69.48                        |
| V <sub>1</sub> T <sub>7</sub> | 24.90             | 26.95   | 234.05                          | 70.22                        |
| V <sub>1</sub> T <sub>8</sub> | 25.19             | 28.03   | 241.98                          | 73.47                        |
| V <sub>2</sub> T <sub>1</sub> | 17.04             | 22.42   | 180.78                          | 71.29                        |
| V <sub>2</sub> T <sub>2</sub> | 17.36             | 24.91   | 189.45                          | 71.95                        |
| V <sub>2</sub> T <sub>3</sub> | 17.65             | 25.40   | 195.29                          | 72.43                        |
| V <sub>2</sub> T <sub>4</sub> | 18.68             | 26.16   | 196.39                          | 72.41                        |
| V <sub>2</sub> T <sub>5</sub> | 19.42             | 26.30   | 197.26                          | 72.57                        |
| V <sub>2</sub> T <sub>6</sub> | 20.30             | 26.67   | 197.77                          | 72.67                        |
| V <sub>2</sub> T <sub>7</sub> | 21.29             | 26.90   | 199.17                          | 73.46                        |
| V <sub>2</sub> T <sub>8</sub> | 22.56             | 27.52   | 201.14                          | 76.90                        |
| SEm±                          | 0.96              | 0.93    | 8.49                            | 1.88                         |
| CD at 5%                      | NS                | NS      | 24.02                           | NS                           |

Application of boron at a higher rate promoted vegetative growth as indicated by shoot length, leaf area and canopy spread of the plants. These results are in accordance with the findings of Verma and Chouhan (16). The probable reason for the maximum vegetative attributes (shoot length, canopy volume and leaf area) under Mango special, IIHR) two sprays before flowering and marble stage application might be due to the promotion of cell division in both the respective cultivars. The present findings are in agreement with the results of Alila et al. (3) in papaya, Shaban et al. (11) in mango and Ruby et al. (9) in litchi.

Significant variation in fruit weight was recorded between the cultivars of mango. The higher fruit weight (221.71 g) was recorded in Langra (V<sub>2</sub>) as compared to Dashehari (V<sub>1</sub>). A perusal of the data indicated that treatment T<sub>7</sub> noted a maximum fruit weight that was 258.68 g, which was statistically at par with T<sub>8</sub> and the minimum weight in control (169.86 g). The maximum polar diameter (9.63 cm) was recorded in Dashehari and the minimum polar diameter in Langra. The maximum equatorial diameter (6.07 cm) was recorded in Langra, whereas, the minimum (5.61 cm) in Dashehari. Maximum fruit length was obtained with T<sub>7</sub> (9.46 cm), which was statistically at par with T<sub>6</sub> and T<sub>8</sub>. A minimum fruit length of 7.46 cm was noted in T<sub>1</sub> (control). The highest number of fruits harvested in tree<sup>-1</sup> was recorded under Langra (306.79), while the minimum number of fruits (230.33) was noted in Dashehari. Micronutrient treatment had

a significant effect on a number of final fruits harvested in tree<sup>-1</sup> and the maximum (282.83) number of fruits were harvested in T<sub>7</sub>, which was the highest as compared to the rest of the treatments and minimum fruit harvested in control. Different concentrations of micronutrients and cultivars had significant effects and the highest number of final fruits harvested tree<sup>-1</sup> (327.67) was recorded in V<sub>2</sub>T<sub>7</sub> (Langra + RDF + Zinc sulphate (100 g) + Copper sulphate (50 g) + Boric acid (50 g) as soil + Zinc sulphate (0.2%) + Copper sulphate (0.1%) + Boric acid (0.1%) as foliar; 2 sprays before flowering and marble stage) and the minimum number of fruits harvested (219.67) was observed in V<sub>1</sub>T<sub>1</sub> (Dashehari + control). The maximum yield of tree<sup>-1</sup> (71.86 kg) and hectare<sup>-1</sup> (7.19 tonnes) were observed in (V<sub>2</sub>) Langra, which was significantly higher as compared to V<sub>1</sub> (Dashehari). The data pertaining to the yield tree<sup>-1</sup> and yield tonnes hectare<sup>-1</sup> were significantly the highest (76.71 kg and 7.67 tonnes) under treatment T<sub>7</sub>, which was statistically at par with T<sub>5</sub>, T<sub>6</sub>, and minimum in control. The highest interaction yield tree<sup>-1</sup> and yield tonnes hectare<sup>-1</sup> were (93.73 kg and 9.37 tonnes) under treatment V<sub>2</sub>T<sub>7</sub>. Significant increases in yield and yield attributes in mango with the application of treatments T<sub>8</sub> and T<sub>7</sub> may be due to optimum vegetative growth, which together accelerated the photosynthetic rate and thereby increased the supply of carbohydrates to plants. The present results are also supported by the findings of Singh et al. (13), Sarkar et al. (10), Kumar et al. (17) and Patel et al. (7).

**Table 3.** Response of mango cultivars to micronutrients on yield attributes

| Treatments/<br>Cultivars   | Fruit weight<br>(g) | Fruit diameter         |                                | No. of<br>fruits/tree at<br>harvest | Yield kg<br>tree <sup>-1</sup> | Yield tones<br>ha <sup>-1</sup> |
|----------------------------|---------------------|------------------------|--------------------------------|-------------------------------------|--------------------------------|---------------------------------|
|                            |                     | Polar<br>diameter (cm) | Equatorial<br>diameter<br>(cm) |                                     |                                |                                 |
| V <sub>1</sub> : Dashehari | 203.58              | 9.63                   | 5.61                           | 230.33                              | 48.76                          | 4.88                            |
| V <sub>2</sub> : Langra    | 221.71              | 7.41                   | 6.07                           | 306.79                              | 71.86                          | 7.19                            |
| SEm±                       | 1.78                | 0.14                   | 0.03                           | 0.58                                | 0.55                           | 0.07                            |
| C.D.5%                     | 5.05                | 0.39                   | 0.10                           | 1.63                                | 1.55                           | 0.20                            |
| Micronutrients             |                     |                        |                                |                                     |                                |                                 |
| T <sub>1</sub>             | 169.86              | 7.46                   | 5.22                           | 249.58                              | 44.89                          | 4.49                            |
| T <sub>2</sub>             | 185.82              | 7.87                   | 5.48                           | 264.33                              | 51.83                          | 5.18                            |
| T <sub>3</sub>             | 196.73              | 8.43                   | 5.80                           | 266.17                              | 56.23                          | 5.62                            |
| T <sub>4</sub>             | 196.73              | 7.89                   | 5.75                           | 267.50                              | 54.72                          | 5.47                            |
| T <sub>5</sub>             | 220.26              | 8.44                   | 5.76                           | 269.50                              | 62.56                          | 6.26                            |
| T <sub>6</sub>             | 223.52              | 9.37                   | 6.17                           | 271.83                              | 62.68                          | 6.27                            |
| T <sub>7</sub>             | 258.68              | 9.46                   | 6.47                           | 282.83                              | 76.71                          | 7.67                            |
| T <sub>8</sub>             | 249.59              | 9.25                   | 6.07                           | 276.75                              | 72.85                          | 7.28                            |
| SEm±                       | 3.57                | 0.27                   | 0.07                           | 1.15                                | 1.10                           | 0.14                            |
| CD at 5%                   | 10.09               | 0.77                   | 0.19                           | 3.27                                | 3.10                           | 0.41                            |
| CV (%)                     | 5.81                | 11.10                  | 3.99                           | 1.49                                | 6.29                           | 8.28                            |

**Table 4.** Interaction effect of mango cultivars to micronutrients on yield and yield attributes

| Treatments                    | Fruit weight<br>(g) | Fruit diameter            |                                | No. of fruits/tree<br>at harvest | Yield kg tree <sup>-1</sup> | Yield tones<br>ha <sup>-1</sup> |
|-------------------------------|---------------------|---------------------------|--------------------------------|----------------------------------|-----------------------------|---------------------------------|
|                               |                     | Polar<br>diameter<br>(cm) | Equatorial<br>diameter<br>(cm) |                                  |                             |                                 |
| V <sub>1</sub> T <sub>1</sub> | 165.35              | 8.61                      | 4.95                           | 219.67                           | 38.07                       | 3.81                            |
| V <sub>1</sub> T <sub>2</sub> | 183.74              | 9.13                      | 5.40                           | 227.00                           | 43.48                       | 4.35                            |
| V <sub>1</sub> T <sub>3</sub> | 185.92              | 9.58                      | 5.67                           | 229.50                           | 44.55                       | 4.45                            |
| V <sub>1</sub> T <sub>4</sub> | 185.92              | 9.14                      | 5.56                           | 228.50                           | 44.11                       | 4.41                            |
| V <sub>1</sub> T <sub>5</sub> | 211.82              | 9.59                      | 5.55                           | 231.00                           | 50.67                       | 5.07                            |
| V <sub>1</sub> T <sub>6</sub> | 218.35              | 10.36                     | 5.89                           | 232.67                           | 51.60                       | 5.16                            |
| V <sub>1</sub> T <sub>7</sub> | 242.88              | 10.43                     | 6.05                           | 238.00                           | 59.69                       | 5.97                            |
| V <sub>1</sub> T <sub>8</sub> | 234.71              | 10.21                     | 5.80                           | 236.33                           | 57.90                       | 5.79                            |
| V <sub>2</sub> T <sub>1</sub> | 174.36              | 6.30                      | 5.48                           | 279.50                           | 51.70                       | 5.17                            |
| V <sub>2</sub> T <sub>2</sub> | 187.89              | 6.60                      | 5.57                           | 301.67                           | 60.18                       | 6.02                            |
| V <sub>2</sub> T <sub>3</sub> | 207.54              | 7.28                      | 5.93                           | 302.83                           | 67.91                       | 6.79                            |
| V <sub>2</sub> T <sub>4</sub> | 207.54              | 6.64                      | 5.95                           | 306.50                           | 65.34                       | 6.53                            |
| V <sub>2</sub> T <sub>5</sub> | 228.69              | 7.29                      | 5.97                           | 308.00                           | 74.44                       | 7.44                            |
| V <sub>2</sub> T <sub>6</sub> | 228.69              | 8.38                      | 6.44                           | 311.00                           | 73.76                       | 7.38                            |
| V <sub>2</sub> T <sub>7</sub> | 274.48              | 8.49                      | 6.90                           | 327.67                           | 93.73                       | 9.37                            |
| V <sub>2</sub> T <sub>8</sub> | 264.48              | 8.29                      | 6.35                           | 317.17                           | 87.80                       | 8.78                            |
| SEm±                          | 5.04                | 0.39                      | 0.10                           | 1.63                             | 1.55                        | 0.20                            |
| CD at 5%                      | NS                  | NS                        | 0.27                           | 4.62                             | 4.38                        | 0.58                            |

The maximum per cent pulp, pulp/ stone ratio and TSS were observed in (V<sub>2</sub>) Langra, which was significantly higher as compared to Dashehari (V<sub>1</sub>). The highest peel: pulp ratio 0.16 was in (V<sub>1</sub>) Dashehari and minimum in (V<sub>2</sub>) Langra. The treatment effect on peel: pulp ratio was found significant and a maximum value (0.18) was observed in treatment T<sub>4</sub>. However, a minimum peel: pulp ratio of 0.12 was observed in T<sub>8</sub> (RDF + Mango special (IIHR) 2 spray before flowering and marble stage). The interaction also possesses significant variation with respect to peel: pulp ratio and the highest peel: pulp ratio of 0.24 was observed in V<sub>1</sub>T<sub>4</sub>. The maximum TSS/acidity ratio was recorded in (V<sub>1</sub>) Dashehari (123.57) and the minimum was observed in

Langra (81.51). Interaction effect had shown a significant effect on the TSS/acidity ratio and recorded the highest (148.60) in treatment combination V<sub>1</sub>T<sub>7</sub>. Whereas, the minimum in 72.76 was in V<sub>2</sub>T<sub>1</sub> (Langra + control). The possible reason for increased pulp thickness could be due to the enhancement of cell division and growth subsequent by zinc spray whereas, increased pulp weight might be due to greater accumulation of carbohydrates, owing to photosynthesis, which resulted in increased production of large-size fruits with pulp. Similarly, boron helps in the development of new cells in meristematic tissue and regulates carbohydrate metabolism & iron helps in the formation of chlorophyll and absorption of other nutrient elements

and resulting in more accumulation in the sink. The above results are in conformity with the findings of Alila *et al.* (3) in papaya.

**Table 5. Effect of Mango Cultivars to micronutrients on fruit quality parameters**

| Treatments/ Cultivars        | Pulp (%) | Pulp: stone ratio | TSS ( $^{\circ}$ Brix) | Peel: pulp ratio | TSS: acidity ratio |
|------------------------------|----------|-------------------|------------------------|------------------|--------------------|
| V <sub>1</sub> : (Dashehari) | 73.99    | 5.32              | 17.24                  | 0.16             | 123.57             |
| V <sub>2</sub> : (Langra)    | 77.22    | 5.91              | 18.63                  | 0.13             | 81.51              |
| SEm $\pm$                    | 0.50     | 0.04              | 0.04                   | 0.003            | 0.64               |
| C.D.5%                       | 1.41     | 0.10              | 0.13                   | 0.008            | 1.80               |
| Micro nutrients              |          |                   |                        |                  |                    |
| T <sub>1</sub>               | 70.79    | 4.46              | 17.33                  | 0.15             | 82.03              |
| T <sub>2</sub>               | 72.41    | 4.57              | 17.39                  | 0.15             | 90.25              |
| T <sub>3</sub>               | 73.62    | 4.76              | 17.68                  | 0.12             | 96.97              |
| T <sub>4</sub>               | 74.08    | 5.07              | 17.60                  | 0.18             | 94.43              |
| T <sub>5</sub>               | 75.00    | 5.09              | 17.89                  | 0.13             | 104.97             |
| T <sub>6</sub>               | 77.55    | 6.07              | 18.13                  | 0.18             | 111.63             |
| T <sub>7</sub>               | 81.23    | 7.82              | 18.81                  | 0.14             | 121.25             |
| T <sub>8</sub>               | 80.17    | 7.09              | 18.64                  | 0.12             | 118.82             |
| SEm $\pm$                    | 0.99     | 0.07              | 0.09                   | 0.006            | 1.27               |
| CD at 5%                     | 2.81     | 0.21              | 0.25                   | 0.017            | 3.60               |
| CV (%)                       | 4.55     | 4.54              | 1.74                   | 14.07            | 4.30               |

**Table 6. Interaction effect of mango cultivars to micronutrients on fruit quality parameters**

| Treatments                    | Pulp (%) | Pulp: stone ratio | TSS ( $^{\circ}$ Brix) | Peel: pulp ratio | TSS: acidity ratio |
|-------------------------------|----------|-------------------|------------------------|------------------|--------------------|
| V <sub>1</sub> T <sub>1</sub> | 69.88    | 0.16              | 16.63                  | 0.16             | 91.31              |
| V <sub>1</sub> T <sub>2</sub> | 71.40    | 0.14              | 16.77                  | 0.14             | 105.25             |
| V <sub>1</sub> T <sub>3</sub> | 71.30    | 0.15              | 17.08                  | 0.15             | 116.74             |
| V <sub>1</sub> T <sub>4</sub> | 71.70    | 0.24              | 17.07                  | 0.24             | 112.68             |
| V <sub>1</sub> T <sub>5</sub> | 72.53    | 0.13              | 17.15                  | 0.13             | 129.29             |
| V <sub>1</sub> T <sub>6</sub> | 76.55    | 0.17              | 17.38                  | 0.17             | 139.24             |
| V <sub>1</sub> T <sub>7</sub> | 80.06    | 0.15              | 18.03                  | 0.15             | 148.60             |
| V <sub>1</sub> T <sub>8</sub> | 78.53    | 0.12              | 17.77                  | 0.12             | 145.47             |
| V <sub>2</sub> T <sub>1</sub> | 71.70    | 0.15              | 18.02                  | 0.15             | 72.76              |
| V <sub>2</sub> T <sub>2</sub> | 73.42    | 0.16              | 18.01                  | 0.16             | 75.25              |
| V <sub>2</sub> T <sub>3</sub> | 75.94    | 0.10              | 18.27                  | 0.10             | 77.20              |
| V <sub>2</sub> T <sub>4</sub> | 76.46    | 0.11              | 18.13                  | 0.11             | 76.18              |
| V <sub>2</sub> T <sub>5</sub> | 77.47    | 0.13              | 18.63                  | 0.13             | 80.65              |
| V <sub>2</sub> T <sub>6</sub> | 78.55    | 0.19              | 18.88                  | 0.19             | 84.01              |
| V <sub>2</sub> T <sub>7</sub> | 82.41    | 0.12              | 19.58                  | 0.12             | 93.90              |
| V <sub>2</sub> T <sub>8</sub> | 81.80    | 0.12              | 19.52                  | 0.12             | 92.16              |
| SEm $\pm$                     | 1.41     | 0.008             | 0.13                   | 0.008            | 1.80               |
| CD at 5%                      | NS       | 0.024             | NS                     | 0.024            | 5.10               |

### Conclusion

In case of micronutrients application T<sub>7</sub> - [RDF + Zinc sulphate (100 g) + Copper sulphate (50 g) + Boric acid (50 g) as soil + Zinc sulphate (0.2%) + Copper sulphate (0.1%) + Boric acid (0.1%) as foliar (2 sprays before flowering and marble stage)] was found superior with respect to yield and quality of mango fruits. By this application, farmers can get 60246 and 79,446 per hectare extra income over control from Dashehari and Langra cultivars, respectively.

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