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## Response of micro-nutrients application on fruit yield and quality of mango

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### Abstract

The experiment was conducted under All India Coordinated Research Project on Fruits at Agriculture Research Station, Banswara (Rajasthan) to evaluate the response of micro-nutrients application on fruit yield and quality of mango cv. Dashehari. The result data indicates that treatment T<sub>7</sub> (i.e. Application of RDF + 100 g Zinc Sulphate + 50 g Copper Sulphate + 50 g Borax (as soil application in tree basin after fruit harvest) + Foliar spray of 0.2% Zinc Sulphate + 0.1% Copper Sulphate + 0.1% Boric acid (2 sprays, just before flowering and at marble stage) was found best with respect to the highest fruit yield (13.09 t/ha) and shelf life of fruits (8.33 days) and it was found significantly at par with treatment T<sub>8</sub>. Further, T<sub>7</sub> treatment was also registered with the highest soil and leaf nutrient status as compared to control.

**Keywords:** Mango, RDF, micro-nutrient, zinc sulphate, copper sulphate, borax and boric acid

### Introduction

Mango (*Mangifera indica* L.) belongs to the family Anacardiaceae originated in Indo-Burma region. The fruit has been in cultivation in Indian sub-continental for well over 4000 years and has been the favourite of the kings and commoners. In order to improve the yield of the crop several micronutrients studied were conducted. The food supplements, multivitamins and mineral supplements are necessary for the healthy crops. According to horticulturists, only application of primary nutrients could not prove successful to produce high quality fruit in mango trees, the application of micro-nutrients is compulsory as well. Major elements/macronutrients are quickly taken up and utilized by the tissues of the plants by the catalyzing effect of micronutrients. Micro-nutrients play a vital role in various enzymatic activities and synthesis of assimilates and hormones. Their acute deficiencies some time poses the problem of incurable nature (Kumar, 2002) [6]. These micronutrients also play an active role in the plant metabolism process starting from cell wall development to respiration, photosynthesis, chlorophyll formation, enzymatic activity, hormone synthesis, nitrogen fixation and reduction etc. Various experiments have been conducted earlier on foliar spray of micro-nutrients in different fruit crops (e.g. in mango, Nehete *et al.*, 2011) [8] shown significant response to improve yield of fruits. Thus keeping above facts in view the present investigation was undertaken with objectives such as to see the influences of micro-nutrients on flowering and fruiting on mango.

### Material and Methods

A field experiment was conducted at Agriculture Research Station, Banswara, MPUAT, Udaipur (Rajasthan). The experiment effect of micro-nutrients on yield & quality of mango cv. Dashehari was conducted on 18-19 years old mango trees planted at 10 × 10 m apart under square system of planting. In order to assess the effects of various treatments, all the trees were managed with uniform cultural practices as per the standard recommendations with respect to manures and fertilizers, irrigation, plant protection measures etc. The experiment was laid out in Randomized Block Design with eight treatments combinations, which were replicated thrice. The treatment details are as; T<sub>1</sub>- Control i.e. RDF (Urea 1.25 kg, SSP 1.0 kg and MOP 0.5 kg/tree) in basin after harvest, T<sub>2</sub>- RDF + 200 g Zinc Sulphate + 100 g Borax (as soil application) in basin after harvest, T<sub>3</sub>- RDF + 200 g Zinc Sulphate + 100 g Copper Sulphate + 100 g Borax (Soil application) in basin after harvest, T<sub>4</sub>- RDF + Foliar spray of 0.2% Zinc Sulphate + Boric acid (0.1%) [2 sprays, just before flowering and marble stage], T<sub>5</sub>- RDF + Foliar spray of 0.2% Zinc Sulphate + Copper Sulphate (0.1%) + Boric acid (0.1%) [2 sprays, just before flowering and marble stage], T<sub>6</sub>- RDF + 100 g Zinc Sulphate + 50 g Copper

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Sulphate + 50 g Borax (Soil application) in basin after harvest + Foliar spray of 0.2% Zinc Sulphate + 0.1% Boric acid (2 sprays, just before flowering and marble stage), T<sub>7</sub>- RDF + 100 g Zinc Sulphate + 50 g Copper Sulphate + 50 g Borax (Soil application) in basin after harvest + Foliar spray of 0.2% Zinc Sulphate + 0.1% Copper Sulphate + 0.1% Boric acid (2 sprays, just before flowering and marble stage), T<sub>8</sub>- RDF + Mango special (IIHR product) @ 5g/ liter water (2 sprays, at 2 months before flowering and fruits of 24 cm diameter stage). The various growth, yield and quality parameters viz. plant height, plant spread, fruit yield (t/ha), increase in yield over control (%), flowering intensity (%), fruit yield/plant (kg), fruit weight (g), shelf life (days), TSS (<sup>0</sup>Brix), acidity (%), grading of fruits on the basis of weight (g), along-with available macro and micro-nutrients in soil and macro and micro-nutrients status in leaves were observed.

### Result and Discussion

The applications of micro-nutrient treatments were found significantly effective in improving the growth, fruit yield and quality characters as presented in Table- 1. Result data indicates that treatment T<sub>7</sub> (RDF + 100 g Zinc Sulphate + 50 g Copper Sulphate + 50 g Borax (as soil application) in basin after harvest + Foliar spray of 0.2% Zinc Sulphate + 0.1% Copper Sulphate + 0.1% Boric acid (2 sprays, just before flowering and marble stage) found best with respect to the highest fruit yield (13.09 t/ha), shelf life of mango fruits (8.33 days) and it was found significantly at par by treatment T<sub>8</sub> and it gave highest yield as compared to control. Further, the fruit quality specially TSS level was also recorded superior in the same treatment T<sub>7</sub>. The treatments T<sub>7</sub>, T<sub>8</sub> and T<sub>4</sub> improved the shelf life of fruits to maximum level i.e. 8.33, 7.66 and 7.66 days, respectively as compared to control (i.e. 6.33 days). The maximum soil and leaf nutrient status registered in T<sub>7</sub>

treatment as compared to control. The micro-nutrients when sprayed alone or in combination involved directly in various physiological processes and enzymatic activity. This might have resulted into better photosynthesis, greater accumulation of starch in fruits. The involvement of Zn in auxin synthesis and B in translocation of starch to fruits. The balance of auxin in plant regulates the fruit drop or retention in plants, which altered the control of fruit drop and increased the total number of fruits per tree. Similar results were observed by Singh *et al.* (2003) [9] and Dutta (2004) [5] in mango. The significant increase in fruit yield (kg/ tree) was a cumulative effect of increase in number of fruits because of reduction in fruit drop vis-a-vis higher fruit weight by the direct and indirect effect of foliar spray of micro-nutrients in mango cv. Alphonso. Promotion of starch formation followed by rapid transportation of carbohydrates in plants activated by micro-nutrients like Zn and B are well established. In the present experiment, foliar spray of micro-nutrient might have affected the physiological processes resulting into higher production of mango cv. Dashehari. This indicated that single chemical or combination of low dose of chemical nutrient did not influence on fruit yield. The results are in conformity with those of Banik and Sen (1997) [1], Dutta and Dhua (2002) [4] and Singh *et al.* (2003) [9] in mango. Increase in TSS by boron application attributed to the rapid mobilization of sugars and other soluble solids from leaves to developing fruits. These findings are in close agreement with the findings of Bhowmick *et al.*, (2011) [3], Singh *et al.*, (2012) [1], Nehete *et al.*, (2011) [8] and Bhatt *et al.*, (2012) [2]. Enzymatic reactions need Zn for transformation of carbohydrates, hexokinase activity and sugar conversion (Dutta and Dhua, 2002) [4]. Similar effect of zinc was found in other fruit crops such as aonla, mango etc. (Meena *et al.*, 2014; Panday and Jain, 2014) [7, 11].

**Table 1:** Effect of micro-nutrients application on growth, fruit yield and quality parameters of mango cv. Dashehari

Treatments	Plant height (m)	Plant spread (m)		Flower-ing intensity (%)	Fruit weight (g)	Fruit yield / plant (kg)	Fruit yield (t/ha)	Increase in yield over control (%)	Shelf Life (days)	TSS ( <sup>0</sup> Brix)	Acidity (%)
		EW	NS								
T <sub>1</sub>	4.18	8.70	8.40	55.50	170	78.0	7.80	6.33	6.33	16.30	0.22
T <sub>2</sub>	4.10	8.55	8.10	56.75	179	84.0	8.40	7.00	7.00	18.70	0.25
T <sub>3</sub>	4.08	8.80	8.05	65.00	181	88.0	8.80	7.33	7.33	17.80	0.26
T <sub>4</sub>	4.60	9.40	8.95	64.20	185	86.0	8.60	7.66	7.66	18.50	0.26
T <sub>5</sub>	4.68	8.35	8.60	65.75	197	118.0	11.80	7.00	7.00	18.60	0.27
T <sub>6</sub>	4.68	7.85	8.35	64.00	205	115.0	11.50	7.33	7.33	17.50	0.26
T <sub>7</sub>	4.60	9.90	9.10	68.00	226	139.0	13.90	8.33	8.33	19.30	0.29
T <sub>8</sub>	4.70	9.40	9.65	60.50	220	132.0	13.20	7.66	7.66	16.90	0.27
S.Em±	0.15	0.40	0.39	2.65	6.03	3.94	0.49	0.33	0.33	0.58	0.01
CD @ 5%	0.46	1.22	1.19	8.03	18.28	11.95	1.50	1.01	1.01	1.75	0.04

**Table 2:** Effect of micro-nutrients application on available macro and micro nutrient in orchard soil of mango cv. Dashehari

Treatments	Macro-nutrients in soil			Micro-nutrients in soil			
	Available N (kg/ha)	Available P <sub>2</sub> O <sub>5</sub> (kg/ha)	Available K <sub>2</sub> O (kg/ha)	Available Cu (ppm)	Available Zn (ppm)	Available Fe (ppm)	Available Mn (ppm)
T <sub>1</sub>	153.95	18.89	240.50	0.24	0.45	3.25	2.45
T <sub>2</sub>	155.92	18.95	243.80	0.25	0.54	3.28	2.52
T <sub>3</sub>	157.58	19.25	245.50	0.30	0.53	3.53	2.65
T <sub>4</sub>	158.25	20.81	246.24	0.29	0.54	3.38	2.68
T <sub>5</sub>	159.50	21.42	246.80	0.32	0.52	3.43	2.72
T <sub>6</sub>	160.25	22.15	247.50	0.35	0.54	3.37	2.75
T <sub>7</sub>	162.75	22.51	248.80	0.36	0.55	3.57	2.78
T <sub>8</sub>	160.10	21.54	245.60	0.25	0.48	3.40	2.74
S.Em±	7.14	0.94	11.05	0.01	0.02	0.15	0.12
CD @ 5%	21.65	2.84	33.51	0.04	0.07	0.47	0.37

**Table 3:** Effect of micronutrients application on status of macro and micro-nutrients in leaves of mango cv. Dashehari

Treatments	Macro-nutrients in leaves			Micro-nutrients in leaves			
	Leaf nutrient N (%)	Leaf nutrient P <sub>2</sub> O <sub>5</sub> (%)	Leaf nutrient K <sub>2</sub> O (%)	Leaf nutrient Cu (ppm)	Leaf nutrient Zn (ppm)	Leaf nutrient Fe (ppm)	Leaf nutrient Mn (ppm)
T <sub>1</sub>	1.11	0.11	0.74	11	10	82	27
T <sub>2</sub>	1.15	0.16	0.72	12	13	84	32
T <sub>3</sub>	1.12	0.17	0.70	12	14	83	37
T <sub>4</sub>	1.17	0.18	0.75	11	13	85	38
T <sub>5</sub>	1.22	0.17	0.87	13	14	84	42
T <sub>6</sub>	1.28	0.16	0.89	12	15	86	43
T <sub>7</sub>	1.38	0.18	0.95	14	16	86	45
T <sub>8</sub>	1.26	0.17	0.85	12	14	84	41
S.Em±	0.05	0.01	0.04	0.55	0.63	3.79	1.77
CD @ 5%	0.17	0.02	0.11	1.67	1.90	11.49	5.37

### Conclusion

On the basis of results obtained during course of investigation it is concluded that treatment T<sub>7</sub>- (i.e. RDF + 100 g Zinc Sulphate + 50 g Copper Sulphate + 50 g Borax (as soil application) in basin after harvest + Foliar spray of 0.2% Zinc Sulphate + 0.1% Copper Sulphate + 0.1% Boric acid (2 sprays, just before flowering and marble stage) was found best with highest yield as compared to control. The fruit quality, specially TSS level was also recorded superior in the same treatment. Besides, T<sub>7</sub> treatment T<sub>8</sub> and T<sub>4</sub> treatments also improved the shelf life of fruits as compared to control. Further, the maximum soil and leaf nutrient status was also registered in T<sub>7</sub> treatment as compared to control.

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