Impact of Foliar Micronutrient Application on Yield and Physical Traits of 'Amrapali' Mango (*Mangifera indica* L.)

ABSTRACTss

The present study highlights about impact of Foliar Micronutrient Application on Yield and Physical Traits of 'Amrapali' Mango (*Mangifera indica* L.). An experiment was conducted at Main Experiment Station, Department of Horticulture, Post Graduate College Ghazipur (U.P.) during the year 2020-2024. In Randomized Block Design with eight treatments *i.e.* Control (water spray), $ZnSO_4$ 1%, $FeSO_4$ 1%, Borax 0.5%, $ZnSO_4$ 1% + $FeSO_4$ 1%, $ZnSO_4$ 1% +Borax 0.5%, $FeSO_4$ 1% + Borax 0.5% and $FeSO_4$ 1% +$ZnSO_4$ 1% + Borax 0.5% in three replications and considering one plants as a unit. The observations were recorded for yield and physico-chemicals attributes of mango fruit. Maximum number of fruits per shoot, fruit retention per cent, fruit yield (kg/tree), and minimum fruit drop were recorded with the application of $FeSO_4$ 1% +$ZnSO_4$ 1% + Borax 0.5% followed by $ZnSO_4$ 1% +Borax 0.5%. All the phyico-chemical characters were influenced by foliar spray of $ZnSO_4$ 1%, $FeSO_4$ 1%, Borax 0.5%, $ZnSO_4$ 1% + $FeSO_4$ 1%, $ZnSO_4$ 1% +Borax 0.5%, $FeSO_4$ 1% + Borax 0.5%, $FeSO_4$ 1% +$ZnSO_4$ 1% + Borax 0.5% in alone. The fruit length, width, fruits weight were recorded maximum with the foliar application of $FeSO_4$ 1% +$ZnSO_4$ 1% + Borax 0.5% followed by $ZnSO_4$ 1% +Borax 0.5%. The application of ZnSO4 at 0.4% topically to increase fruit volume showed a nearly identical pattern. The mango fruit's weight, pulp, and stone ratio were measured.

Keywords: *Mangifera indica*, therapeutic properties, Amrapali variety, foliar application

INTRODUCTION

With 44% of the global mango production, India is the leading mango-producing nation. There are good chances of developing a thriving market for the export of this fruit to other nations, along with its byproducts, such as mango juice in bottles and slices in cans. Mangoes are currently exported to almost 20 nations, while its products are shipped to more than 40 countries. Nevertheless, the current outcome is disappointingly minimal. Mangos have the potential to generate significant foreign cash for India by exporting both raw and processed mangoes. Large tracts of land might be developed and used to expand the production of this desirable fruit in a profitable and beneficial manner. Mangos have special nutritional and therapeutic properties in addition to being high in carbohydrates and vitamins A and C. 73.0–86.7% moisture, 11.6-24.3% carbs, 0.3–1.0% protein, 0.1–0.8% fat, 0.3–0.7% mineral, 650–25900 µg vitamin A, and 3-83 mg vitamin C are found in every 100 grams of mango fruit. According to nutritional experts, ripe mango fruits are not only visually appealing and tasty, but they also have fattening, laxative, diuretic, and highly stimulating properties. 9.5% of seed kernels are protein, 8–12% are fat, 79.2% are starch, 2% are mineral content, and 2% are fiber. In addition to being useful for propagation, the stones make excellent cow stock feed.

MATERIALS AND METHODS

The present investigation was carried out at Main Experiment Station, Department of Horticulture, P.G. College Ghazipur, under Veer Bahadur Singh Purvanchal University Jaunpur (U.P.) during the year 2020 -2024. In the current study, 16 year-old, uniform mango plants spaced 2.5 x 2.5 m apart served as the experimental subjects. There are seven micronutrients viz ZnSO4 1%, FeSO4 1%, Borax 0.5%, ZnSO4 1% + FeSO4 1%, ZnSO4 1% + Borax 0.5%, FeSO4 1% + Borax 0.5% and FeSO4 1% + ZnSO4 1% + Borax0.5% along with control. Thus total eight treatments were tested in randomized block design with three replications to see the impact of these treatments on yield attributing characters and yield of Amrapali variety of mango. [12] Observations on number of fruits per shoot, fruit length, fruit width, fruit volume, stone weight of fruit, pulp weight, pulp stone ratio,

fruit drop, fruit retention and fruit yield per tree were recorded and subjected to statistical analysis. The results were given below.

RESULTS AND DISCUSSION

A. Yield attributes and yield:

Tables 1, 2, 3, 4, respectively, provide an overview of the data on the quantity of fruits per shoot, fruit drop %, fruit retention percentage, and fruit yield (kg/tree). The results indicate that the T8 FeSO4 1%+ ZnSO4 1%+ Borax 0.5% and T6 ZnSO4 1% + Borax 0.5% sprays yielded the maximum fruit retention, fruit production (kg/tree), with the least fruit drop percentage, and number of fruits per shoot. Conversely, fruit retention %, minimum number of fruits per shoot, and maximum fruit drop all suggest water control (water spray). The greater fruit retention could be the result of an increase in the body's natural levels of auxin and other metabolites. Zinc is known to be essential for the synthesis of auxin (IAA) because it activates the enzyme tryptophan synthetase.

Table-1: Effect of foliar spray of nutrients on number of fruits per shoot

Treatments	No. of fruit per shoot		
	2021-22	2022-23	Average
T_1 : Control (Water spray) 1.09	1.15	1.18	1.165
T_2 : $ZnSO_4$ 1%	2.55	2.64	2.595
T_3 :$FeSO_4$ 1%	1.77	1.85	1.81
T_4 : Borax 0.5%	2.46	2.55	2.505
T_5 : $ZnSO_4$ 1% + $FeSO_4$ 1%	2.04	2.11	2.075
T_6 : $ZnSO_4$ 1% + Borax 0.5%	2.68	2.78	2.73
T_7 : $FeSO_4$ 1% + Borax 0.5%	2.61	2.71	2.66
T_8 : $FeSO_4$ 1% + $ZnSO_4$ 1% + Borax 0.5%	2.75	2.83	2.79
S. Em ±	**0.069**	**0.072**	**0.0705**
CD at 5%	**0.209**	**0.22**	**0.2145**

CV	**5.313**	**5.382**	**5.3475**

Table-2: Effect of foliar spray of nutrients on fruit drop

Treatments	Fruit drop (%)		
	2021-22	**2022-23**	**Average**
T_1 : Control (Water spray)	96.04	96.01	96.025
T_2: $ZnSO_4$ 1%	93.8	93.78	93.79
T_3 : $FeSO_4$ 1%	96.87	96.85	96.86
T_4 : Borax 0.5%	94.24	94.21	94.225
T_5 : $ZnSO_4$ 1% + $FeSO_4$ 1%	95.45	95.42	95.435
T_6: $ZnSO_4$ 1% + Borax 0.5%	93	92.96	92.98
T_7: $FeSO_4$ 1% + Borax 0.5%	93.32	93.3	93.31
T_8 : $FeSO_4$ 1% + $ZnSO_4$ 1%+ Borax 0.5%	91	90.98	90.99
S. Em ±	**0.866**	**0.863**	**0.8645**
CD at 5%	**2.627**	**2.618**	**2.6225**
CV	**1.594**	**1.588**	**1.591**

Table-3: Effect of foliar spray of nutrients on fruit retention

Treatments	Fruit retention (%)		
	2021-22	**2022-23**	**Average**
T_1 : Control (Water spray)	3.96	3.99	3.975
T_2: $ZnSO_4$ 1%	6.2	6.22	6.21
T_3 : $FeSO_4$ 1%	3.13	3.15	3.14
T_4 : Borax 0.5%	5.76	5.79	5.775
T_5 : $ZnSO_4$ 1% + $FeSO_4$ 1%	4.55	4.58	4.565
T_6: $ZnSO_4$ 1% + Borax 0.5%	7	7.04	7.02
T_7: $FeSO_4$ 1% + Borax 0.5%	6.68	6.7	6.69

T_8 : $FeSO_4$ 1% + $ZnSO_4$ 1%+ Borax 0.5%	9	9.02	9.01
S. Em ±	**0.135**	**0.152**	**0.1435**
CD at 5%	**0.41**	**0.46**	**0.435**
CV	**4.049**	**4.519**	**4.284**

Fruit retention under sprays appears to have increased, indicating that the treatments have impacted the auxin balance to prevent fruit loss. These results closely align with a finding made by Ruby and Brahmachari (2001) that a substantial reduction in fruit drop occurred when litchi were treated with 1% zinc sulfate. Kumar et al. (2008) discovered that the most effective treatment for increasing the quantity of beautiful flowers and fruit retention in mango cv. Amrapali was a foliar application of urea 2% combination with ZnSO4 0.5% or Borax 0.5%. Vashistha et al. (2010) Additionally, urea at 1%+ZnSO4 at 0.4%+Borax at 0.4% applied topically resulted in the greatest number of fruits/shoots and fruit retention, while water spray (control) produced the fewest fruits and fruit retention in mango fruit (Mangifera indica L.) cv. Amrapali. Khan et al. (2010) found that when applied topically to Aonla fruits, 0.5% ZnSO4 + 0.1% thiourea was followed by 0.25% Borax + 0.1% thiourea. According to fruit yield (kg/tree) statistics, spraying T6 ZnSO4 1% + Borax 0.5% after applying T8 FeSO4 1% + ZnSO4 1% + Borax 0.5% was the most effective technique to increase fruit output. when the minimum fruit production of a control tree was observed. The increased fruit yield resulting from foliar nutrition application could be attributed to improved nutrient uptake through efficient absorption and, consequently, more lush vegetative growth in the first phases, which generated more metabolites for the fruit's development. importance of these nutrients in improving physiological processes that increase fruit weight, width, and length, which in turn increases yield.

Table-4: Effect of foliar spray of nutrients on fruit yield.

Treatments	Fruit yield(kg/tree)		
	2021-22	2022-23	Average
T_1 : Control (Water spray)	17.4	17.73	17.565
T_2: $ZnSO_4$ 1%	23.33	23.78	23.555
T_3 : $FeSO_4$ 1%	18.59	18.95	18.77
T_4 : Borax 0.5%	21.87	22.29	22.08
T_5 : $ZnSO_4$ 1% + $FeSO_4$ 1%	21.19	21.6	21.395
T_6: $ZnSO_4$ 1% + Borax 0.5%	24.54	25.02	24.78
T_7: $FeSO_4$ 1% + Borax 0.5%	23.78	24.24	24.01
T_8 : $FeSO_4$ 1% + $ZnSO_4$ 1%+ Borax 0.5%	25.24	25.73	25.485
S. Em ±	**0.525**	**0.488**	**0.5065**
CD at 5%	**1.593**	**1.481**	**1.537**
CV	**4.136**	**3.733**	**3.9345**

The present finding is consistent with the conclusions of Singh (2002), They found that when zinc spray was applied, either by itself or in combination with other nutrients, the yield of Aonla cv. NA-10 was much higher than the control. Similarly, Bhowmick et al. (2012) revealed that Amrapali mangoes received a 0.5% foliar spray of borax.

B. Physical characters of fruit:

The statistics (Tables 5 and 6, respectively) clearly showed that all treatments increased fruit size relative to the control by a significant amount. Using (T8) FeSO4 1%+ ZnSO4 1%+ Borax 0.5% spray, the maximum fruit length and width were measured. The minimum fruit width and length for the control treatment were recorded. The effective metabolite absorption and accumulation of the fruit during its early stages of development could account for fruit size increases caused by nutrient spraying. Spraying the plant with zinc-rich ZnSO4 may have reduced the permeability of the cell walls, increasing the amount of water that could be mobilized in the fruit and increasing its size.

Table-5: Effect of foliar spray of nutrients on fruit length.

Treatments	Fruit length(cm)		
	2021-22	2022-23	Average
T_1 : Control (Water spray)	8.38	8.64	8.51
T_2: $ZnSO_4$ 1%	9.37	9.66	9.515
T_3 : $FeSO_4$ 1%	8.6	8.87	8.735
T_4 : Borax 0.5%	9.24	9.52	9.38
T_5 : $ZnSO_4$ 1% + $FeSO_4$ 1%	8.78	9.05	8.915
T_6: $ZnSO_4$ 1% + Borax 0.5%	10.51	10.83	10.67
T_7: $FeSO_4$ 1% + Borax 0.5%	9.83	10.13	9.98
T_8 : $FeSO_4$ 1% + $ZnSO_4$ 1%+ Borax 0.5%	10.68	11.01	10.845
S. Em ±	**0.208**	**0.238**	**0.223**
CD at 5%	**0.63**	**0.722**	**0.676**
CV	**3.816**	**4.242**	**4.029**

These results closely match the findings of other guava researchers (Pal et al., 2008; Singh et al., 2011).

Table- 6: Effect of foliar spray of nutrients on fruit width.

Treatments	Fruit width (cm)			
	2021-22		2022-23	Average
T_1 : Control (Water spray)	5.45		5.59	5.52
T_2: $ZnSO_4$ 1%	5.87		6.03	5.95
T_3 : $FeSO_4$ 1%	5.59		5.75	5.67
T_4 : Borax 0.5%	5.83		5.99	5.91
T_5 : $ZnSO_4$ 1% + $FeSO_4$ 1%	5.77		5.93	5.85
T_6: $ZnSO_4$ 1% + Borax 0.5%	6.2		6.37	6.285
T_7: $FeSO_4$ 1% + Borax 0.5%	6.04		6.2	6.12
T_8 : $FeSO_4$ 1% + $ZnSO_4$ 1%+ Borax	6.46		6.64	6.55

0.5%				
S. Em ±	**0.131**		**0.132**	**0.1315**
CD at 5%	**0.397**		**0.4**	**0.3985**
CV	**3.844**		**3.764**	**3.804**

Maximum fruit length and breadth were also obtained in the mango cultivar Himsagar by foliar treatments of Zn (0.5%) + B (0.2%) + Mn (1%) + Ca (0.6%) and organic mulching (10 cm thick of dried leaves). When compared to the control group, fruit weight and volume rose considerably across all treatments (Table 7). However, the highest impact was observed with the application of T8 FeSO4 1%+ ZnSO4 1%+ Borax 0.5%. Zinc may have been used as a result of the pulp's higher concentration and faster cell division. The increase in fruit weight brought on by zinc spraying may be the result of extra food material building up in fruit trees.

Table-7: Effect of foliar spray of nutrients on fruit weight [13]

Treatments	**Fruit weight (g)**		
	2021-22	**2022-23**	**Average**
T_1 : Control (Water spray)	142.19	144.01	143.1
T_2: $ZnSO_4$ 1%	165.18	167.3	166.24
T_3 : $FeSO_4$ 1%	155.08	157.07	156.075
T_4 : Borax 0.5%	163.48	165.58	164.53
T_5 : $ZnSO_4$ 1% + $FeSO_4$ 1%	158.25	160.28	159.265
T_6: $ZnSO_4$ 1% + Borax 0.5%	189.48	191.91	190.695
T_7: $FeSO_4$ 1% + Borax 0.5%	173.99	176.23	175.11
T_8 : $FeSO_4$ 1% + $ZnSO_4$ 1%+ Borax 0.5%	201.05	203.64	202.345
S. Em ±	**4.233**	**3.814**	**4.0235**
CD at 5%	**12.84**	**11.569**	**12.2045**
CV	**4.349**	**3.869**	**4.109**

Conclusion

It has been demonstrated that spraying ZnSO4 on fruit can significantly increase both its weight and volume. Kumar et al. (2004) found that topically applying Zn (0.5%, 1.0%), B (0.4%, 0.6%), Cu (0.5%, 1.0%), and NAA (15 mg 1-1) significantly increased the weight of the fruit. Goswami et al. (2012) found that applying ZnSO4 topically increased the fruit volume of guava (*Psidium guajava L.*) cv. Sardar. The application of ZnSO4 at 0.4% topically to increase fruit volume showed a nearly identical pattern. The mango fruit's weight, pulp, and stone ratio were measured.

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