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A multimicronutrient's impact on the fruit yield and quality of custard apple (*Annona squamosa* L.) cv. Sindhan

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Abstract
The study experiment was conducted on "A multimicronutrient's impact on the fruit yield and quality of custard apple (*Annona squamosa* L.) cv. sindhan" at Horticultural Research Farm, Department of Horticulture, B. A. College of Agriculture, Anand Agricultural University, Anand during *kharif* season at the year of 2022. The experiment was laid out in Randomized Block Design with nine treatment and replicated thrice with two plants in each replication of a treatment. Treatment Details are Control (T_1), 0.5% spray of multimicronutrient (Grade-IV) (T_2), 1% spray of multimicronutrient (Grade-IV) (T_3), 1.5% spray of multimicronutrient (Grade-IV) (T_4), 250 g/tree soil application of multimicronutrient (Grade-V) (T_5), 400 g/tree soil application of multimicronutrient (Grade-V) (T_6), 500 g/tree soil application of multimicronutrient (Grade-V) (T_7), 0.5% spray of multimicronutrient (Grade-IV) + 250 g/tree soil application of multimicronutrient (Grade-V) (T_8), 1% spray of multimicronutrient (Grade-IV) + 500 g/tree soil application of multimicronutrient (Grade-V) (T_9). All the treatment was applied two times during the crop season at end of June and end of July. Among all the treatment, T_9 (1% spray of multimicronutrient (Grade-IV) + 500 g/tree soil application of multimicronutrient (Grade-V)) treatment recorded significantly maximum fruit weight, fruit volume, fruit diameter, number of fruits per plant, yield, pulp weight (93.96 g) and pulp: seed ratio. The same treatment also improve fruit quality attributes like total soluble solids, ascorbic acid, total sugar, reducing sugar and non-reducing sugar.

Keywords: Custard apple, multimicronutrient, grade, yield and quality

1. Introduction
One of the significant tropical fruit crops in India is the custard apple (*Annona squamosa* L.). It is a West Indies native and a member of the Annonaceae family. However, custard apples are typically utilized as a fruit for dessert. The seeds and pulp are both employed medicinally (Pinto *et al*., 2005) [10]. Custard apples are seen as being less significant economically over the world. In India, custard apples are the most popular annonaceous fruit. Custard apple fruit is referred to as "poor man's fruit." Typically, only the poorest classes in India consume the fruit. But of days, wealthy people are using fresh fruit in initiated as well.

Even though they are needed in comparatively smaller amounts, micronutrients are just as crucial for plant metabolism as main nutrients (Katyal, 2004) [6]. Despite the fact that micronutrients exist in the soil, nutrient interactions may limit their absorption. Foliar therapy is built on the notion that nutrients are quickly absorbed by leaves and dispersed to different plant parts to satisfy functional nutritional requirements. Without a doubt, applying nutrients topically is the best solution to the issue of nutritional availability. In order for the trees to grow healthily and produce fruit with exceptional quality, the nutritional state of the trees must be restored through the application of micronutrients to the soil. Application of micronutrients to the soil improves its physico-chemical properties, nutrient content, and fertility.

2. Materials and Methods
The experiment was conducted at the Horticultural Research Farm, Department of Horticulture, B. A. College of Agriculture, Anand Agricultural University, Anand, during the kharif season of 2022. It used a Randomised Block Design with nine treatments that were reproduced three times, each with two plants. Treatment Details are Control (T_1), 0.5% spray of multimicronutrient (Grade-IV) (T_2), 1% spray of multimicronutrient (Grade-IV) (T_3), 1.5% spray of multimicronutrient (Grade-IV) (T_4), 250 g/tree soil application of multimicronutrient (Grade-V) (T_5), 400 g/tree soil application of multimicronutrient (Grade-V) (T_6), 500 g/tree soil application of multimicronutrient (Grade-V) (T_7), 0.5% spray of multimicronutrient

(Grade-IV) + 250 g/tree soil application of multimicronutrient (Grade-V) (T_8), 1% spray of multimicronutrient (Grade-IV) + 500 g/tree soil application of multimicronutrient (Grade-V) (T_9). The mature and uniformly sized fruits were harvested from each tree, and observations were made regarding the fruit yield parameters. All treatments were applied twice during the crop season, at the ends of June and July. Recommendations for doses of Vermicompost and NPK fertilisers were given as common doses in all treatments.

3. Result and Discussion

Tables 1, 2, 3, and 4 list the impact of multimicronutrients on yield and quality metrics.

3.1 Yield Parameters

The weight, volume, and diameter of the custard apple fruit were significantly affected by the foliar and soil application of multimicronutrients. Among all the treatments, T_9 (1% spray of multimicronutrient (Grade-IV) + 500 g/tree soil application of multimicronutrient (Grade-V)) was recorded significantly maximum fruit weight (203.45 g), fruit volume (169.78 cc) and fruit diameter (7.88 cm). It might be because boron actively contributes to the transit of carbohydrates in plants, whereas iron is required for cell growth and division. The possible reason for the increased fruit weight can be attributed to the increased fruit diameter, which can be attributed to a greater translocation of food components from source to sink under the influence of applied micronutrients, which in turn leads to a rapid protein synthesis and translocation. The above results were confirmed by the findings of Goswami *et al.* (2014) [3], Rajkumar *et al.* (2014) [11] in guava Singh and Varma (2011) [14], Bhatt *et al.* (2012) [1], Sankar *et al.* (2013) [12] in mango.

Application of multimicronutrients to the soil and leaves had a substantial impact on fruit output and fruit production. Among all the treatment, T_9 (1% spray of multimicronutrient (Grade-IV) + 500 g/tree soil application of multimicronutrient (Grade-V)) was recorded significantly maximum number of fruit per plant (105.80) and fruit yield (21.00 kg/plant and 8.40 t/ha). It might be due to when Zinc, Iron, and Boron are sprayed separately or together, they directly affect several physiological processes and enzymatic activity, which leads to a higher accumulation of food materials and, eventually, a higher yield. Better photosynthesis and the buildup of starch in fruits were produced by the auxin-producing zinc and the starch-translocating boron. The balance of auxin in a plant also controls whether fruits drop off or are retained, which increases the overall quantity of fruits produced per tree. According to reports, boron plays a part in fruit setting, which ultimately leads to an increase in the number of fruits produced per tree. The similar results were confirmed by the findings of, Jat and Kacha (2014) [5], Rajkumar *et al.* (2014) [11] in guava, Bhowmick *et al.* (2012) [2], Sankar *et al.* (2013) [12], Gurjar *et al.* (2015) [4] and Krishnamoorthy *et al.* (2015) [8] in mango.

3.2 Quality Parameters

Total soluble solids and ascorbic acid were significantly affected by the foliar and soil treatment of multimicronutrients. Among all the treatment, T_9 (1% spray of multimicronutrient (Grade-IV) + 500 g/tree soil application of multimicronutrient (Grade-V)) was recorded significantly highest total soluble solids (25.98 °Brix) and ascorbic acid content (21.03 mg/100 g). Tryptophan is a precursor to auxin, thus it's possible that zinc increased tryptophan synthesis as the cause. It is crucial for protein synthesis, sugar metabolism, and preserving the integral structure. On the other hand, the increased Total Soluble Solids may be due to boron's connection to the cell membrane, where it may interact with sugar molecules and facilitate their transit through the membrane. This observation is in agreement with findings of Bhatt *et al.* (2012) [1], Bhowmick *et al.* (2012) [2] in mango. And for the ascorbic acid, It might be due to higher of level of sugar due to micronutrient application including boron might be the possible cause behind increase in ascorbic acid content which is synthesized from sugar. Similar results were obtained by Kazi *et al.* (2012) [7] in sweet orange.

There were significant effect of foliar and soil application of multimicronutrient on total sugar, reducing sugar and non-reducing sugar. Among all the treatment, T_9 (1% spray of multimicronutrient (Grade-IV) + 500 g/tree soil application of multimicronutrient (Grade-V)) was recorded significantly maximum total sugar (24.88%), reducing sugar (18.89%) and non-reducing sugar (5.98%). This could be as a result of the combined effect of these micronutrients on the percentage of non-reducing sugars, which was mostly related to improved polysaccharide translocation in mature fruits. Singh *et al.* (2012) [13] observed a similar outcome. The good influence that micronutrients have on the conversion of polysaccharides into simple sugars is directly correlated with an increase in reducing sugars. Kumar and Shukla (2010) [9] reported both direct and indirect impacts of micronutrients on fruit quality, and they also achieved results that were comparable

Table 1: Effect of multimicronutrient on fruit weight, fruit volume and fruit diameter on custard apple

Treatment No.	Treatments	Fruit weight (g)	Fruit volume (cc)	Fruit diameter (cm)
T_1	Control	163.30	143.07	6.92
T_2	0.5% spray of multimicronutrient (Grade-IV)	178.88	154.59	7.30
T_3	1% spray of multimicronutrient (Grade-IV)	194.63	162.40	7.65
T_4	1.5% spray of multimicronutrient (Grade-IV)	183.97	158.01	7.40
T_5	250 g/tree soil application of multimicronutrient (Grade-V)	165.94	147.50	7.03
T_6	400 g/tree soil application of multimicronutrient (Grade-V)	166.94	148.35	7.19
T_7	500 g/tree soil application of multimicronutrient (Grade-V)	173.01	152.03	7.22
T_8	0.5% spray of multimicronutrient (Grade-IV) + 250 g/tree soil application of multimicronutrient (Grade-V)	197.43	166.96	7.78
T_9	1% spray of multimicronutrient (Grade-IV) + 500 g/tree soil application of multimicronutrient (Grade-V)	203.45	169.78	7.88
S.Em. ±		4.63	3.78	0.15
CD at 5%		13.88	11.33	0.46
CV (%)		4.43	4.20	3.64

Table 2: Effect of multimicronutrient on Number of fruits per plant and fruit yield on custard apple

Treatment No.	Treatments	Number of fruits per plant	Fruit Yield (kg/plant)	Yield (t/ha)
T_1	Control	91.21	15.00	6.00
T_2	0.5% spray of multimicronutrient (Grade-IV)	98.11	17.50	7.00
T_3	1% spray of multimicronutrient (Grade-IV)	101.64	18.42	7.37
T_4	1.5% spray of multimicronutrient (Grade-IV)	95.80	17.70	7.08
T_5	250 g/tree soil application of multimicronutrient (Grade-V)	96.83	16.50	6.60
T_6	400 g/tree soil application of multimicronutrient (Grade-V)	93.27	17.40	6.96
T_7	500 g/tree soil application of multimicronutrient (Grade-V)	94.67	17.60	7.04
T_8	0.5% spray of multimicronutrient (Grade-IV) + 250 g/tree soil application of multimicronutrient (Grade-V)	104.63	19.62	7.85
T_9	1% spray of multimicronutrient (Grade-IV) + 500 g/tree soil application of multimicronutrient (Grade-V)	105.80	21.00	8.40
S.Em. ±		3.51	0.82	0.33
CD at 5%		10.53	2.46	0.98
CV (%)		6.20	7.98	7.98

Table 3: Effect of multimicronutrient on TSS and Ascorbic acid on custard apple

Treatment No.	Treatments	TSS (°Brix)	Ascorbic acid (mg/100 g)
T_1	Control	22.50	17.80
T_2	0.5% spray of multimicronutrient (Grade-IV)	23.73	18.80
T_3	1% spray of multimicronutrient (Grade-IV)	24.57	20.18
T_4	1.5% spray of multimicronutrient (Grade-IV)	24.30	19.40
T_5	250 g/tree soil application of multimicronutrient (Grade-V)	22.61	18.13
T_6	400 g/tree soil application of multimicronutrient (Grade-V)	22.88	18.21
T_7	500 g/tree soil application of multimicronutrient (Grade-V)	23.45	18.49
T_8	0.5% spray of multimicronutrient (Grade-IV) + 250 g/tree soil application of multimicronutrient (Grade-V)	25.36	20.91
T_9	1% spray of multimicronutrient (Grade-IV) + 500 g/tree soil application of multimicronutrient (Grade-V)	25.98	21.03
S.Em. ±		0.43	0.58
CD at 5%		1.27	1.73
CV (%)		3.08	5.21

Table 4: Effect of multimicronutrient on total sugar, reducing sugar and non-reducing sugar on custard apple

Treatment No.	Treatments	Total sugar (%)	Reducing sugar (%)	Non-reducing sugar (%)
T_1	Control	20.49	15.70	5.07
T_2	0.5% spray of multimicronutrient (Grade-IV)	23.11	17.13	5.53
T_3	1% spray of multimicronutrient (Grade-IV)	23.79	17.94	5.73
T_4	1.5% spray of multimicronutrient (Grade-IV)	23.42	17.48	5.65
T_5	250 g/tree soil application of multimicronutrient (Grade-V)	21.34	16.29	5.19
T_6	400 g/tree soil application of multimicronutrient (Grade-V)	22.25	16.54	5.34
T_7	500 g/tree soil application of multimicronutrient (Grade-V)	22.50	16.76	5.46
T_8	0.5% spray of multimicronutrient (Grade-IV) + 250 g/tree soil application of multimicronutrient (Grade-V)	24.30	18.63	5.87
T_9	1% spray of multimicronutrient (Grade-IV) + 500 g/tree soil application of multimicronutrient (Grade-V)	24.88	18.8	5.98
S.Em. ±		0.57	0.51	0.15
CD at 5%		1.71	1.53	0.45
CV (%)		4.31	5.11	4.72

4. Conclusion

From the present investigation it can be concluded that the two times application of (1% spray of multimicronutrient (Grade-IV) + 500 g/tree soil application of multimicronutrient (Grade-V)) was given at end of June and end of July, respectively. Treatment T_9 (1% spray of multimicronutrient (Grade-IV) + 500 g/tree soil application of multimicronutrient (Grade-V)) improve the yield attributes *viz.*, fruit weight, volume, diameter, No. of fruits per plant, yield (kg/plant and t/ha). The same treatment also improve fruit quality attributes like total soluble solids, ascorbic acid, total sugar, reducing sugar and non-reducing sugar.

5. References

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