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Studies on effect of soil and foliar application of micronutrients on quality parameters of sweet orange Var. Nucellar (*Citrus sinensis* Osbeck)

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Abstract
An experiment was conducted to study the effect of soil and foliar application of micronutrients on quality parameters of sweet orange (*Citrus sinensis* Osbeck) Var. Nucellar." was carried out at Sweet Orange Research Station, Badnapur, Dist. Jalna during 2018-19. The experiment was laid out in Randomized Block Design (RBD) with 15 treatments and three replication. Observations were recorded on quality characters of sweet orange. The results were revealed that, the quality parameters like juice %, reducing sugar, non-reducing sugar, acidity, T.S.S, ascorbic acid, pH, total sugar, are most effective in (T_{13}) Soil application of $ZnSO_4$ @ 150 gm + $MnSO_4$ @ 150 gm + Foliar spray of $ZnSO_4$ @ 0.5 % + $MnSO_4$ @ 0.5 % followed by (T_{14}) Soil application of $ZnSO_4$ @ 100 gm + $MnSO_4$ @ 100 gm + Foliar spray of $ZnSO_4$ @ 1% + $MnSO_4$ @ 1%.

Keywords: TSS, acidity, pH

Introduction
Citrus is the leading fruit crop of the world. Citrus fruits are a fair source of vitamin C and their daily consumption protects mankind from scurvy, a disease commonly associated with inadequate availability of vitamin C in the dietary foods. Citrus fruits are cultivated in India in four different zones i.e. Central India (Maharashtra, Gujarat and Madhya Pradesh), Southern India (Andhra Pradesh and Karnataka), North-Western India (Punjab, Rajasthan, Haryana and Western UP) and North-Eastern India (Meghalaya, Assam and Sikkim). Sweet orange is considered as most important fruit crop of citrus group with their wholesome nature multifold nutrition and medicinal value have made them so important. Sweet orange (*Citrus sinensis* Osbeck) belongs to family Rutaceae. Sweet orange is native of Southern China. It is now widely distributed and naturalized in sub-tropical zone of India. In Sweet Orange 100 g fruit contains 60-80% fruit juice, protein 0.8-1.4 g, fat 0.2-0.4 g, fiber 0.8 g, vitamin-A 198 I.U, 0.113 mg vitamin B_1, 0.046 mg riboflavin, 65.69 mg vitamin C, 0.2-0.8 mg iron, 0.16 mg calcium, potassium 192-201 mg. Sweet Orange tree is medium to large with dense foliage, generally with slender somewhat flexible rather blunt spines in the axils of leaves, leaves oval or ovate oblong, smooth, shiny, lighter below, margin entire, petioles smaller than those of *Citrus aurantium*, calyx cupped, sepals four or five thick greenish, persistent, petals usually five thick, fleshy recurved, stamens 20-25 hypogenous, filaments flattened, inverted in group shorter than petals distinctly divide into stigma, style and ovary, stigma knob like, style long and slender, ovary rounded.10-14 loculed fruit globose or oblate, light orange to reddish, rind smooth, pulp juicy, sub-acid. Yellow to orange or redish, core solid. Peel tight juice sacs spindle shaped, seeds few or many, white inside highly poly embryonic.
India is 6th largest producer in sweet orange. It contributes to about 49 per cent of the total production in the Country. In Maharashtra area under sweet orange cultivation is 107.00 thousand ha with production of 652.00 thousand MT and productivity 6.1 MT/ha. Commercially sweet orange is grown on Khera district of Gujarat state and Jalna, Aurangabad, Nanded district of Maharashtra state, (Anonymous, 2016) [2].
The sweet orange fruits are also important from agro-industrial point of view. The sweet orange fruit is processed commercially into various forms mainly juice, frozen concentrates, squash, RTS drinks, nectar, dry mixes, canned segments, juice blends, marmalades and other value added products like pectin and essential oils.

From peel, natural colours, candied peel, feed yeast etc. Fresh juice of sweet orange is an important nutritious product providing 45Kcal energy, moderate quantity of vitamin "C", potassium, bioflavonoid, folic acid and essential items of breakfast.

Citrus is micro nutrient loving fruit crop. Presently the yield of citrus crop is reducing due to some nutrient *Viz*., Zn, Mn, Fe, B, etc. among these Zn and Mn plays very significant role in growth, yield and quality of citrus. Deficient micronutrients not only reduce the productivity of crops but also reduce the efficiency of applied major nutrients. Micronutrients deficiencies are increasing and can be expected to continue. Higher yields are being obtained putting greater demand on soil nutrients.

Sweet orange is grown widely in the different districts of Maharashtra but Jalna, Aurangabad, Nanded and Parbhani are the major area in production, among them Jalna is dominant in area and production (Karegonkar *et al.* 2011) [8] Nucellar cultivar has been under cultivation in this region, but now a day's area under sathgudi mosambi is increasing day by day due to more market demand. Sathgudi fruits are good acid sugar ratio, more juice percentage i.e., thin peel thickness. Moreover sathgudi fruits are produced in less grades i.e. two or three grades. Nucellar mosambi is an established cultivar of the region having good yield potential and excellent taste of juice. Hence it was become necessary to test performance of both the cultivars in Marathwada region to know their growing and overall performance.

Hence, the present investigations was proposed to generate sufficient data base for balanced fertilization arriving at ideal nutrient management practices and effect of micronutrients application for optimum and good quality production of sweet orange.

Material and Methods

The experiment was conducted during 2018-19, on uniform 8 years old plants of Var. Nucellar mosambi planted at the spacing of 6x6m at the Sweet Orange Research Station, Badnapur, district Jalna of Vasantrao Naik Marathwada Krishi Vidyapeeth, Parbhani. Station is situated at 409 m above mean sea level at 19.87°N latitude and 75.72°E longitudes with an altitude of 523 meters. The average rainfall of the station is about 650 mm received mostly during June to September. The mean minimum and maximum temperature during the last five years were 15.25 0C and 43.85 0C and the mean relative humidity ranges from 30 to 90 percent and rainfall in the year 2018 is 437 mm. Experiment was laid out in a Randomized Block Design (RBD) with three replication and fifteen treatments these are control i.e. (T_1), Soil application of $ZnSO_4$ **@** 100 gm/plant (T_2), Soil application of $ZnSO_4$@ 150gm/plant (T_3), Soil application of $ZnSO_4$@ 200gm/plant (T_4), Soil application of $MnSO_4$ **@** 100g/plant (T_5), Soil application of $MnSO_4$ @ 150gm/plant (T_6), Soil application of $MnSO_4$ @ 200gm/plant (T_7), Foliar spray of $ZnSO_4$ @ 0.5%/plant (T_8), Foliar spray of $ZnSO_4$ @1%/plant (T_9), Foliar spray of $MnSO_4$ @ 0.5 % plant (T_{10}), Foliar spray of $MnSO_4$@1%/plant (T_{11}), Soil application of $ZnSO_4$ @ 100 gm + $MnSO_4$ @ 100gm + Foliar spray of $ZnSO_4$ @ 0.5 % + $MnSO_4$ @ 0.5 % (T_{12}), Soil application of $ZnSO_4$ @ 150 gm + $MnSO_4$ @ 150 gm + Foliar spray of $ZnSO_4$ @ 0.5 % + $MnSO_4$ @ 0.5 % (T_{13}), Soil application of $ZnSO_4$ @ 100 gm + $MnSO_4$ @ 100 gm + Foliar spray of $ZnSO_4$ @ 1% + $MnSO_4$ @ 1% (T_{14}), Soil application of $ZnSO_4$ @ 150 gm + $MnSO_4$ @ 150 gm + Foliar spray of $ZnSO_4$ @ 1% + $MnSO_4$ @ 1% (T_{15}). Juice was extracted by a fruit juice extractor and filtered through a muslin cloth and weighed. The percentage was calculated as per the following formula:

$$\text{Juice (\%)} = \frac{\text{Weight of Juice}}{\text{Weight of fruit}} \text{ X } 100$$

The percentage of total soluble solids of each sample was determined with the help of a Hand Refractometer. The freshly extracted juice of a composite sample of single fruit was taken into a beaker and its pH was recorded with the help of electrically operated "pH meter" The pH meter was calibrated before recording the pH values with the help of Buffer tables. For determination of acidity, 10 ml of juice was diluted to 250 ml with the help of distilled water. The known volume of the juice was then titrated against (0.1 N) NaOH solution using phenolphthalein as an indicator. This was measured by using Burette. A known quantity of juice was taken. After clarification with lead acetate and deleading with potassium oxalate, reducing sugars were estimated by Fehling's solution with methylene blue as an indicator (Lane and Eynon 1923 [10] method given by the percentage of non reducing sugars was estimated by subtracting the reducing sugars from total sugars. Determination of ascorbic acid was done by 2, 6 – Di chloro phenol Indophenol dye method of Johnson (1948) [7] as described by A known quantity of sample was blended with (3 percent) Metaphosphoric acid (HPO_3) to make the final volume of (100 ml) and then filtered. A known quantity of aliquot was titrated against (0.025 percent) 2, 6 - Dichlorophenol Indophenol dye to a pink colour end point. The ascorbic acid content of the sample was calculated taking into consideration the dye factor and expressed as mg Ascorbic acid per 100 g fruit pulp.

$$\text{Mg of Ascorbic Acid/100 g juice} = \frac{\text{(Titrate value} \times \text{Dye factor} \times \text{volume made up)}}{\text{Aliquot taken for estimation} \times \text{Wt. or volume of sample taken for estimation.}} \text{ X } 100$$

Results and Discussion

It is clear from the data given in table that, the maximum TSS (12.23) was recorded in the treatment T_{13} i.e., Soil application of $ZnSO_4$ @ 150 gm + $MnSO_4$ @ 150 gm + Foliar spray of $ZnSO_4$ @ 0.5 % + $MnSO_4$ @ 0.5 % followed by treatment T_{14} (12.15) i.e. Soil application of $ZnSO_4$ @ 100 gm + $MnSO_4$ @ 100 gm + Foliar spray of $ZnSO_4$ @ 1% + $MnSO_4$ @ 1% and T_{15} (11.62) i.e. Soil application of $ZnSO_4$ @ 150 gm + $MnSO_4$ @ 150 gm + Foliar spray of $ZnSO_4$ @ 1% + $MnSO_4$ @ 1% which were statistically at par with T_{12} (11.55) i.e. Soil application of $ZnSO_4$ @ 100 gm + $MnSO_4$ @ 100gm + Foliar spray of $ZnSO_4$ @ 0.5 % + $MnSO_4$ @ 0.5 %. The minimum TSS was recorded in T_1 (10.15) i.e. control, and T_{13} (12.23) was statistically superior over the control. The maximum juice percent (53.48%) was recorded in the treatment T_{13} i.e. Soil application of $ZnSO_4$ @ 150 gm + $MnSO_4$ @ 150 gm + Foliar spray of $ZnSO_4$ @ 0.5 % + $MnSO_4$ @ 0.5 % followed by the treatment T_{14} (52.61%) i.e. Soil application of $ZnSO_4$ @ 100 gm + $MnSO_4$ @ 100 gm + Foliar spray of $ZnSO_4$ @ 1% + $MnSO_4$ @ 1% and T_{15} (51.85%) i.e. Soil application of $ZnSO_4$ @ 150 gm + $MnSO_4$ @ 150 gm + Foliar spray of $ZnSO_4$ @ 1% + $MnSO_4$ @ 1% which were statistically at par with T_{12} (49.16%), i.e. Soil application of $ZnSO_4$ @ 100 gm + $MnSO_4$ @ 100gm + Foliar spray of $ZnSO_4$ @ 0.5 % + $MnSO_4$ @ 0.5 %. The minimum juice percent content was recorded in control T_1 (39.67). The maximum ascorbic acid (53.53%) was recorded in treatment T_{13} i.e. Soil application of $ZnSO_4$ @ 150 gm + $MnSO_4$ @ 150 gm + Foliar spray of $ZnSO_4$ @ 0.5

% + $MnSO_4$ @ 0.5 % followed by the treatments T_{14} (51.92%) i.e. Soil application of $ZnSO_4$ @ 100 gm + $MnSO_4$ @ 100 gm + Foliar spray of $ZnSO_4$ @ 1% + $MnSO_4$ @ 1% and T_{15} (48.26%) i.e. Soil application of $ZnSO_4$ @ 150 gm + $MnSO_4$ @ 150 gm + Foliar spray of $ZnSO_4$ @ 1% + $MnSO_4$ @ 1% which were statistically at par with treatment T_{10} (46.07%) i.e. Foliar spray of $MnSO_4$@0.5%./plant. The minimum Vitamin C content was recorded in control in T_1 (40.11%) Thus, it is obvious that all the treatments of T_{13} i.e. Soil application of $ZnSO_4$ @ 150 gm + $MnSO_4$ @ 150 gm + Foliar spray of $ZnSO_4$ @ 0.5 % + $MnSO_4$ @ 0.5 %, T_{14} i.e. Soil application of $ZnSO_4$ @ 100 gm + $MnSO_4$ @ 100 gm + Foliar spray of $ZnSO_4$ @ 1% + $MnSO_4$ @ 1% and T_{15} i.e. Soil application of $ZnSO_4$ @ 150 gm + $MnSO_4$ @ 150 gm + Foliar spray of $ZnSO_4$ @ 1% + $MnSO_4$ @ 1% proved beneficial for ascorbic acid over control (T_1). Present investigation clearly indicated that the Soil application of $ZnSO_4$ @ 150 gm + $MnSO_4$ @ 150 gm + Foliar spray of $ZnSO_4$ @ 0.5 % + $MnSO_4$ @ 0.5 % treatment had significant effect on chemical characteristics of Sweet Orange fruit. Sajid *et al.,* (2012) [11] also reported that foliar application of Zinc and boron significantly enhanced fruit juice content, total soluble solids (TSS), ascorbic acid and of sweet orange fruit. However, fruit juice content, TSS and ascorbic acid were observed significantly higher, when the fruit was treated with high Zinc (1%) and low boron (0.02%). Similar result were observed, concluded that in sweet orange maximum T.S.S, juice and ascorbic acid with the application of multimicronutrients and NPK either applied through soil or fertigation, where as ascorbic acid of the fruit juice was found highest in balanced nutrient application. The increase in T.S.S was due to increase in photosynthesis activity (kulkarni, 2002) [9] Similar observations were recorded by and highest TSS in sweet orange with foliar application of $ZnSO_4$ + Borax was noted.

Application of multimicronutrients along with NPK might have improved tree health and this could be the main reason for increase in juice content. It has been reported by various researchers that balanced nutrition considerably increased the juice content in the fruits of healthy trees. Devi *et al*., (1997) [5] who found that juice content of sweet orange fruits was significantly increased when the plants were supplied with soil application of $ZnSO_4$, $FeSO_4$ and $MnSO_4$ at 50g/tree and combined foliar spray of the micronutrient at 0.5% concentration. The maximum reducing sugar was recorded in the treatment T_{13} (3.14%) i.e. Soil application of $ZnSO_4$ @ 150 gm + $MnSO_4$ @ 150 gm + Foliar spray of $ZnSO_4$ @ 0.5 % + $MnSO_4$ @ 0.5 % followed by the treatment T_{14} (3.08%) i.e. Soil application of $ZnSO_4$ @ 100 gm + $MnSO_4$ @ 100 gm + Foliar spray of $ZnSO_4$ @ 1% + $MnSO_4$ @ 1% and which were statistically at par with T_{15} (3.03%) i.e. Soil application of $ZnSO_4$ @ 150 gm + $MnSO_4$ @ 150 gm + Foliar spray of $ZnSO_4$ @ 1% + $MnSO_4$ @ 1% and which are statistically at par with T_5 (2.91%) i.e. Soil application of $MnSO_4$ **@**100 gm/plant**.** The minimum reducing sugar was recorded in the treatment T_1 (1.98) i.e., control. The maximum non- reducing sugar in T_{13} i.e. Soil application of $ZnSO_4$ @ 150 gm + $MnSO_4$ @ 150 gm + Foliar spray of $ZnSO_4$ @ 0.5 % + $MnSO_4$ @ 0.5 % (4.84%), and followed by the treatment T_{14} i.e. Soil application of $ZnSO_4$ @ 100 gm + $MnSO_4$ @ 100 gm + Foliar spray of $ZnSO_4$ @ 1% + $MnSO_4$ @ 1% (4.83%), T_8 i.e. Foliar spray of $ZnSO_4$ @ 0.5%/plant (4.55%) and which were statistically at par with T_{15} i.e. Soil application of $ZnSO_4$ @ 150 gm + $MnSO_4$ @ 150 gm + Foliar spray of $ZnSO_4$ @ 1% + $MnSO_4$ @ 1% (4.51%). The data presented in table maximum total sugar was recorded in the treatment T_{13} (7.99%), followed by treatment T_{14} and T_{15} (7.91 and 7.54%) respectively and were statistically at par by the treatment T_{12} (7.34%). Present investigation clearly indicated that the Soil application of $ZnSO_4$ @ 150 gm + $MnSO_4$ @ 150 gm + Foliar spray of $ZnSO_4$ @ 0.5 % + $MnSO_4$ @ 0.5 % treatment had show significant effect on chemical characteristics of Sweet Orange fruit.

Concluded that the significant effect of multi-micronutrients application resulted in a significant increase in reducing, non-reducing and total sugars in sweet orange fruits. These multi-micronutrients treatments comprised of boron and Zinc along with other micronutrients, which have an important role in sugar metabolism. these results are supported by the findings of Dixit *et al.,* (1977) [6], who found increase in sugar content of juice in kinnow mandarin fruits due to foliar sprays of $ZnSO_4$+$FeSO_4$ similar results were recorded by Anees *et al*., (2011) [1] reported that the maximum total soluble solids (27.9 Brix^o), ascorbic acid / vitamin C contents (153.3%), total sugars (50.08), reducing (19.92%) and non reducing sugars (8.83%) were found in 0.4% $FeSO_4$ + 0.8% H_3BO_3 + 0.8% $ZnSO_4$ in mango. The maximum pH was recorded in treatment T_{13} (4.09) i.e. Soil application of $ZnSO_4$ @ 150 gm + $MnSO_4$ @ 150 gm + Foliar spray of $ZnSO_4$ @ 0.5 % + $MnSO_4$ @ 0.5 %. Titrable acidity was maximum recorded in treatment T_1 (0.48 %) i.e., control and minimum in (T_{13}) Present investigation clearly indicated that the Soil application of $ZnSO_4$ @ 150 gm + $MnSO_4$ @ 150 gm + Foliar spray of $ZnSO_4$ @ 0.5 % + $MnSO_4$ @ 0.5 % treatment had show significant effect on chemical characteristics of Sweet Orange fruit. Concluded the decreased acidity in micronutrient treated fruit juice might be due to their utilization in respiration and rapid metabolic transformation of organic acids into sugars (Brahmahachari *et al*., 1997) [3]. The results obtained in this present investigation were in agreement with those of Devi *et al*., (1997) [5] in sweet orange. Similar results were also reported by Deolankar and Firke (2001) [4] in banana.

Table 1: Effect of soil and foliar application of micronutrients on Different chemical attributes of Sweet Orange fruits.

T. No.	Treatment details	T.S.S	Juice %	Ascorbic acid (mg/100ml juice)	Reducing sugar (%)	Non-Reducing sugar (%)	Total sugar (%)	pH	Titrable acidity (%)
T1	Control	10.15	39.67	40.11	1.98	3.72	5.70	3.38	0.48
T2	Soil application of $ZnSO_4$ **@** 100 gm/plant	10.31	40.63	42.41	2.88	3.87	6.75	3.83	0.45
T3	Soil application of $ZnSO_4$@ 150gm/plant	10.36	44.70	45.53	2.26	4.06	6.33	3.73	0.46
T4	Soil application of $ZnSO_4$@ 200gm/plant	10.32	41.59	43.70	2.17	4.46	6.63	3.64	0.47
T5	Soil application of $MnSO_4$ **@** 100g/plant	10.44	47.4	45.14	2.91	3.57	6.48	3.53	0.46
T6	Soil application of $MnSO_4$ @ 150gm/plant	10.82	48.20	42.38	2.52	3.62	6.15	3.78	0.42
T7	Soil application of $MnSO_4$ @ 200gm/plant	10.51	49.09	44.75	2.62	3.97	6.60	3.77	0.44
T8	Soil application of $MnSO_4$ @ 200gm/plant	10.67	47.44	41.77	2.70	4.55	7.26	3.66	0.43
T9	Foliar spray of $ZnSO_4$ @1%/plant	10.74	46.47	43.97	2.83	4.49	7.33	3.76	0.46
T10	Foliar spray of $MnSO_4$ @ 0.5 %plant	11.22	48.14	46.07	2.53	3.41	5.94	3.62	0.44

T11	Foliar spray of $MnSO_4$@1%/plant	11.37	44.04	44.86	2.64	3.79	6.43	3.84	0.47
T_{12}	Soil application of $ZnSO_4$ @ 100 gm + $MnSO_4$ @ 100gm + Foliar spray of $ZnSO_4$ @ 0.5 % + $MnSO_4$ @ 0.5 %	11.55	49.16	45.01	2.86	4.48	7.34	3.92	0.43
T13	Soil application of $ZnSO_4$ @ 150 gm + $MnSO_4$ @ 150 gm + Foliar spray of $ZnSO_4$ @ 0.5 % + $MnSO_4$ @ 0.5 %	12.23	53.48	53.53	3.14	4.84	7.99	4.09	0.37
T_{14}	Soil application of $ZnSO_4$ @ 100 gm + $MnSO_4$ @ 100 gm + Foliar spray of $ZnSO_4$ @ 1% + $MnSO_4$ @ 1%	12.15	52.61	51.92	3.08	4.83	7.91	4.04	0.38
T_{15}	Soil application of $ZnSO_4$ @ 150 gm + $MnSO_4$ @ 150 gm + Foliar spray of $ZnSO_4$ @ 1% + $MnSO_4$ @ 1%	11.62	51.85	48.26	3.03	4.51	7.54	3.94	0.41
SE ±		0.13	1.23	1.42	0.11	0.099	0.17	0.16	0.01
C.D.at 5%		0.38	3.53	4.11	0.32	0.28	0.49	0.48	0.03

References

1. Anees M, Tahir FM, Shahzad J, Mahmood N. Effect of foliar application of micronutrients on the quality of mango (*Mangifera indica* L.) cv. Dashehari fruit. *Mycopath.* 2011; 9(1):25-28.
2. Anonymous. Methods of Vitamin Assay. Interscience publisher, London, 1966.
3. Brahmachari VS, Yadav GS, Naresh K. Effect of feeding of calcium, Zinc and boron on yield and quality attributes of litchi (*Litchi chinensis* Sonn.) Orissa J Hort. 1997; 25(1):49-52.
4. Deolankar KP, Firake NN. Effect of water soluble fertilizers on growth and yield of banana. J Maharashtra agricultural univarcity. 2001; 26(3):333-334.
5. Devi DD, Srinivasan PS, Balkrishan K. Effect of zinc, iron and manganese on yield and quality of sweet orange cv. Sathgudi Madras Agric. J. 1997; 84(8):460-463.
6. Dixit CK, Yamdagni RY, Jindal PC. A note on the effect of micronutrients spray on quality of kinnow- a-mandarin hybrid. Haryana J Horti. Sci. 1977; 6(3-4):153-154.
7. Johnson BC. Method of Vitamin 'C' determination. Burgess publ. co., Minneapolis, 1948, 98p.
8. Karegonkar SS, Patel VM, Sanap DJ, Babar AP. Economic analysis of production and physibility of Sweet orange garden in jalna district of Maharashtra. Agric. Update. 2011; 6:70-74.
9. Kulkarni NH. Effect of growth regulators and micronutrients on fruit drop, yield and quality in sweet orange (*Citrus sinensis* Osbeck). Unpublished Ph.D thesis, Marathwada Agricultura Univarsity, Parbhani, India, 2002.
10. Lane JH, Eynons L. Determination of reducing sugars Fehling's solution with methylene blue as internal indicator. J Soc. Chem. Ind. 1923; 42:32.
11. Sajid M, Rab A, Jan I, Haq I, Shah ST, Iqbal A *et al.* Preharvest treatment of Zn and B affects the fruit quality and storability of sweet orange. J of Agri. Sci. and Technology. 2012; 2(12):1224-233.