*Int.J.Curr.Microbiol.App.Sci* (2022) *11*(10): 89-94

*International Journal of Current Microbiology and Applied Sciences*
***ISSN: 2319-7706*** **Volume 11 Number 10 (2022)**
Journal homepage: http://www.ijcmas.com

**Original Research Article** https://doi.org/10.20546/ijcmas.2022.1110.011

# Studies on Leaf Nutrient Status in Relation to Yield Attributes of Sweet Orange (*Citrus sinensis* L.) Cv. Nucellar

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**Keywords**

Leaf Nutrient status, yield, sweet orange, basaltic parent material

**Article Info**

***Received:***
08 September 2022
***Accepted:***
28 September 2022
***Available Online:***
10 October 2022

**A B S T R A C T**

An experiment was carried out at College of Agriculture, Latur, M. S. India during *Summer* and *Kharif* season of 2014-15 to study the nutrient status of leaf of sweet orange orchards of Jalna district. In order to know the leaf nutrient status, ten sweet orange orchards located in ten different talukas of Jalna district were randomly selected. Leaf samples were collected from second, third or fourth leaf of four to six month old non fruiting branches during July-August 2014. Leaf samples were collected from second, third or fourth leaf from non fruiting branches of randomly selected five trees from each orchard. The leaf analysis revealed that leaf nutrient values for N, K. Ca, Mg, Zn and Cu were optimum in 10, 90, 60, 40, 70, 10 and 30 percent orchards respectively. While N, P and Zn found deficient in 90, 100 and 90 percent orchards respectively. The fruit yield had significant and positive correlation with leaf N, Ca and Mn.

## Introduction

Sweet orange (*Citrus sinensis* L.) belongs to the family *Rutaceae* and originated in China. It is grown in tropical and subtropical climate in the world for their sweet fruits, which can be eaten fresh or processed to obtain juice. In world, the global production of oranges record 48.8 MMT (Anonymous, 2015). In India, citrus is grown in an area of 846 thousand ha and production of 8.80 MT/ha (Anonymous, 2011). Maharashtra is the largest producer of sweet orange in the country and contributes to about 49% of the total production. Sweet orange is grown widely in 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.

The soils of this region are desired from basaltic parent material and are deficient in nutrients including N, P, Fe, Mn and Zn. Therefore, above facts are essential to create information about leaf nutrient status of sweet orange trees so as to develop fertilizer schedule for sweet orange orchards of Jalna

district. Considering the above facts, the present investigation was made to study leaf nutrient status in relation to yield of sweet orange to find out the relation between nutrient status and yield.

## Materials and Methods

An experiment was carried out during summer 2014-15 at ten sweet orange orchards located in different talukas of Jalna district during year 2014-15. Majority of soil are medium to deep black and categorized under order vertisols and inceptisols.

In order to know leaf nutrient status, the leaf samples were collected from second, third or fourth leaf from non fruiting branches during July-August 2014. The details of selected sweet orange orchards of Jalna district are given in Table 1.

Facing all four directions at height of 1.5 to 1.8 m from ground level at each sampling hundred leaves were collected from the four to six month old twig of mrig flush as per the procedure described by Singh *et al.,* (1990). Collected leaf samples were brought to laboratory. The leaves were washed with water for 3-4 times.

The samples were air dried on perfectly clean surface at room temperature for 2-3 days in dust free atmosphere free from any kind of contaminants.

Samples were placed in electric oven at $60^0$c for 48 hours and grind in an electric stainless still mill using 0.5 mm sieve. Then the samples were placed in oven to dry for few hours more till constant weight and stored in well stopper plastic for analysis.

The leaf nitrogen was determined by calorimetric method (USDA, 1954). Phosphorus was determined by spectrophotometer method (USDA, 1954). Potassium was determined by Flame Photometric Method (USDA, 1954).

Ca & Mg was determined in the di-acid digest of plant tissue using atomic absorption Spectrophotometer. Micronutrient (Mn, Zn and Cu) were determined in the di-acid digest of plant tissue using atomic absorption Spectrophotometer.

The total yield of harvested fruit was weighed from each tree on a pan balance. The data of yield per tree was recorded and from that yield per hectare was calculated.

## Results and Discussion

### Leaf nutrient status

### Leaf Nitrogen (N) content

Data from Table 2 clearly indicates that the Nitrogen content of orchards varied from 1.46-2.56 percent (on dry weight) basis with an average of 2.05. The lowest Nitrogen (1.46) was observed in sample J5007. Whereas the highest nitrogen (2.58) was recorded in sample JS006. The N content was low in 90 percent orchards surveyed. Similar results were observed by Reddy *et al.*,(2013) in the range of 1.80-2.50.

### Leaf Phosphorus (P) content

Data from Table 2 clearly indicated that the phosphorus content of various orchards varied from 0.10-0.19 with average value of 0.14. The highest 'P' (0.19) content was observed in sample JS009, whereas lowest P (0.10) was recorded in sample JS010. Kohali *et al.,* (1998) also reported range of leaf 'P' 0.09 to 0.19 percent in mandarin orchards of Central India.

### Leaf Potassium (K) content

It was evident from the data presented in Table 2 that the potassium contents of the leaves of different orchards varied from 0.78-1.58 with an average value of 1.17. The highest 'K' (1.58) was recorded in sample JS006, whereas lowest K (0.78) was recorded in sample JS0010. The similar range 0.62-0.97 per cent was observed by Reddy *et al.,* (2013) in Nagpur mandarin.

### Leaf Calcium (Ca) Content

The leaf Ca content of orchards varied from 2.94 to 4.51 per cent with an average value of 3.56. The findings can be supported by findings of Gathala *et al.,* (2004).

### Leaf Magnesium (Mg) content

Data from Table 2 clearly indicated that the leaf Mg contents of different sweet orange orchards was varied from 0.35 to 0.46 per cent. Kohli *et al.,* (1998) also reported that 'Mg' content varied from 0.12 to 1.36 per cent in Nagpur.

### Leaf Manganese (Mn) content

The data from Table 2 clearly indicated that the leaf Mn contents of different sweet orchards varied from 87.80 to 56.12 ppm. Khokhar *et al*., (2012) reported that the 'Mn' content varied from 16.78 to 36.78 ppm in Kinnow orchards of Ludhiyana (Punjab).

### Leaf Zinc (Zn) content

The data from Table 2 clearly indicated that the 'Zn' contents of different orchards under investigation was varied fom 17.80 to 25.00 ppm. Sharma *et al.,* (1990) also reported that 'Zn' contents of mandarin orchards under investigation were varied from 9.0 to 31.0 ppm.

### Leaf Copper (Cu) content

The data from Table 2 clearly indicated that the 'Cu' content of different sweet orange orchards varied from 6.30 to 9.87 ppm. Ranjha *et al.,* (2002) also reported similar range 6.0 to 22.0 ppm in citrus orchards and these findings are mostly in agreement with present findings.

### Yield Attributes

### Number of fruits per tree

The maximum number of fruits (550 per tree) was recorded in sample JS009. It might be due to high nutrient status of nutrients in general and more P, K, Ca, Mn and Cu in leaves. These results are in confirmity with Karla *et al.,* (1989).

### Yield kg /tree

The maximum yield (137.94 kg / tree) was recorded in sample JS009, whereas, minimum (101.52 kg / tree) was recorded in sample JS004. These results are in confirmity with Fang *et al.,* (2010).

### Yield (Mt/ha)

The maximum yield (38.20 Mt/ha) was recorded in sample JS009 whereas minimum yield (28.12 MT/ha) was recorded in sample JS004. The variation in yield may be due to variation of nutrient status, variation in age and management practices of orchards. The high yielding orchards has highest rhizosphere as well as high leaf nutrient status.

These results are in confirmity with Verma *et al.,* (2012) surveyed 18 orchards of Nagpur mandarin in Jhalawar district of Rajasthan and reported that estimated yield was (43.50 t/ha).

### Correlation coefficient between leaf nutrient status and fruit yield

Data from Table 4 showed that the fruit yield had significant and positive correlation with leaf N, Ca and Mn, also leaf P, K, Mg, Zn and Cu were positively correlated with fruit yield. The similar results found by Patil (2010) in Mango.

**Table.1** Details of selected sweet orange orchards of Jalna district.

| Sr. No. | Sample No. | Name of Cultivator | Name of Tahsil | Name of Village |
|---|---|---|---|---|
| **1** | JS 001 | Laxman T. Kachare | Jalna | Kacharewdi |
| **2** | JS 002 | Balaji N. Kachare | Jalna | Kacharewadi |
| **3** | JS 003 | Sandeep T. Kolhe | Badnapur | Deogaon |
| **4** | JS 004 | Haribhau B. Ghate | Jalna | Dukri Pimpri |
| **5** | JS 005 | Abhay A. Shendre | Ambad | Pimpalgaon |
| **6** | JS 006 | Vilas B. Kharat | Ambad | Dhangar Pimpari |
| **7** | JS 007 | Bhimrao R. Pund | Partur | Pimparkheda |
| **8** | JS 008 | Sanjay S. Shere | Mantna | Waturphata |
| **9** | JS 009 | Dnyaneshwar B. Dahatonde | Ghansawangi | Talegoan |
| **10** | JS 010 | Vinod B. Mahajan | Ghansawangi | Talegoan |

**Table.2** Leaf nutrient status of sweet orange orchards of Jalna district (0% dry weight)

| Sample No. | Nitrogen (N) | Phosphorous (P) | Potassium (K) | Calcium (Ca) | Magnesium (Mg) | Manganese (ppm) | Zinc (ppm) | Copper (ppm) |
|---|---|---|---|---|---|---|---|---|
| **JS001** | 2.30 | 0.14 | 1.23 | 4.13 | 0.42 | 58.70 | 20.10 | 7.74 |
| **JS002** | 1.75 | 0.13 | 1.17 | 3.35 | 0.41 | 45.40 | 23.40 | 8.37 |
| **JS003** | 2.18 | 0.14 | 1.14 | 3.64 | 0.43 | 52.30 | 24.90 | 9.11 |
| **JS004** | 1.68 | 0.18 | 1.12 | 3.42 | 0.39 | 38.13 | 21.50 | 6.80 |
| **JS005** | 1.70 | 0.11 | 1.16 | 3.12 | 0.46 | 41.58 | 19.60 | 8.60 |
| **JS006** | 2.56 | 0.18 | 1.58 | 3.42 | 0.40 | 56.12 | 22.40 | 6.59 |
| **JS007** | 1.46 | 0.14 | 1.10 | 3.91 | 0.38 | 48.40 | 17.80 | 6.30 |
| **JS008** | 2.37 | 0.12 | 1.23 | 3.23 | 0.35 | 43.80 | 23.90 | 9.38 |
| **JS009** | 2.35 | 0.19 | 1.28 | 4.51 | 0.45 | 47.80 | 25.00 | 9.87 |
| **JS010** | 2.13 | 0.10 | 0.78 | 2.94 | 0.37 | 37.80 | 23.70 | 6.30-9.87 |
| **Range** | 1.46-2.56 | 0.10-0.19 | 0.78-1.58 | 2.94-4.51 | 0.35-0.46 | 37.80-56.12 | 17.80-25.00 | 8.24 |
| **Mean** | 2.05 | 0.14 | 1.17 | 3.56 | 0.33 | 46.95 | 22.23 | 1.34 |
| **Critical limits** | 0.37 | 0.03 | 0.19 | 0.49 | 0.35 | 7.19 | 2.44 | |

**Table.3** Yield attributes of different sweet orange orchards

| Sample No. | No. of Fruits Tree$^{-1}$ | Yield kg tree$^{-1}$ | Yield Tonns$^{-1}$ |
|---|---|---|---|
| **JS001** | 529.00 | 128.81 | 35.68 |
| **JS002** | 510.00 | 120.26 | 33.31 |
| **JS003** | 519.00 | 125.47 | 34.75 |
| **JS004** | 432.00 | 101.52 | 28.72 |
| **JS005** | 448.00 | 107.57 | 29.79 |
| **JS006** | 540.00 | 132.58 | 36.72 |
| **JS007** | 514.00 | 122.39 | 33.90 |
| **JS008** | 490.00 | 115.20 | 31.91 |
| **JS009** | 550.00 | 137.94 | 38.20 |
| **JS010** | 490.00 | 118.64 | 32.86 |
| **SE±** | 12.54 | 3.50 | 0.97 |
| **CD at 5 %** | 38.55 | 11.20 | 3.10 |

**Table.4** Correlation coefficient between leaf nutrient status and yield.

| Leaf Nutrients | 'r' Value |
|---|---|
| **N** | 0.61** |
| **P** | 0.37 |
| **K** | 0.43 |
| **Ca** | 0.65** |
| **Mg** | 0.24 |
| **Mn** | 0.72** |
| **Zn** | 0.30 |
| **Cu** | 0.14 |

Abbreviations :- *= Significant at 5 % level **= Significant at 1 % level.

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**How to cite this article:**

Rathod, S. M. and Sable, P. B. 2022. Studies on Leaf Nutrient Status in Relation to Yield Attributes of Sweet Orange (*Citrus sinensis* L.) Cv. Nucellar. *Int.J.Curr.Microbiol.App.Sci.* 11(10): 89-94.
doi: https://doi.org/10.20546/ijcmas.2022.1110.011