Journal of Pharmacognosy and Phytochemistry

Available online at www.phytojournal.com

**E-ISSN:** 2278-4136
**P-ISSN:** 2349-8234
www.phytojournal.com
JPP 2020; 9(4): 3370-3372
Received: 16-05-2020
Accepted: 18-06-2020

**PS Pawar**
Assistant Professor, AICRP on Fruits, Department of Horticulture, MPKV, Rahuri, Maharashtra, India

**VK Garande**
Officer Incharge, AICRP on Fruits, Department of Horticulture, MPKV, Rahuri, Maharashtra, India

**BR Bhite**
Senior Research Assistant, National Agriculture Research Project, Solapur, Maharashtra, India

**Corresponding Author:**
**PS Pawar**
Assistant Professor, AICRP on Fruits, Department of Horticulture, MPKV, Rahuri, Maharashtra, India

# Effect of vermicompost and biofertilizers on growth, yield and fruit quality of sweet orange (*Citrus sinensis* L. Osbeck) cv. Mosambi

**PS Pawar, VK Garande and BR Bhite**

**Abstract**
A field experiment on effect of vermicompost and biofertilizers on growth, yield and fruit quality of sweet orange (*Citrus sinensis* L. Osbeck) cv. Mosambi was carried out at All India Coordinated Research Project on Fruits, Department of Horticulture, Mahatma Phule Krishi Vidyapeeth, Rahuri, Dist-Ahmednagar during the period 2013-14 to 2017-18. The results obtained that the use of vermicompost and biofertilizers affects on growth, yield and fruit quality of sweet orange. The maximum plant height (3.40 m), fruit weight (197.47 g), number of fruits (292.12 fruits/tree), yield (57.69 kg/tree and 15.97 t/ha), juice (48.05%), TSS (10.00 ºBrix), ascorbic acid (55.32 mg/100 ml juice), reducing sugars (4.20%), non-reducing sugars (3.16%), total sugars (7.34%) and B : C ratio (1.78) with minimum acidity (0.46%) were recorded in treatment $T_4$ i. e. application of 75% Vermicompost (On N-equivalent basis of RDF) + *Trichoderma harzianum* (30-40 ml/plant) + Azadirachtin (1% at 3-4 ml/litre as spray) + *Pseudomonas fluorescence* (30-40 ml/plant). From the results, it was recommended that application of 75% Vermicompost (On N-equivalent basis of RDF) + Trichoderma harzianum (30-40 ml/plant) + Azadirachtin (1% at 3-4 ml/litre as spray) + Pseudomonas fluorescens (30- 40 ml/plant) in the month of January is recommended for better growth, yield, quality fruits and shelf life of fruits in *Ambia bahar* of sweet orange planted in medium black soils of Western Maharashtra.

**Keywords:** Vermicompost, biofertilizers, sweet orange, growth, yield, fruit quality, B: C ratio

## Introduction
Sweet orange (*Citrus sinensis* L. Osbeck) is one of the most important fruit crop amongst the citrus group in India particularly in Maharashtra state. In Maharashtra, sweet orange is grown on an area of 55,200 hectares with total production of 6,84,800 MT and productivity of 12.40 MT/ha [1]. The productivity of sweet orange in Maharashtra is significantly lower than in some of the frontline citrus growing state like Andhra Pradesh. There is a need to increase sweet orange production. To increase sweet orange production, balanced fertilizer application is of very important factor for getting maximum growth, yield and quality fruits. Large scale use of chemical fertilizers causes problem of ground water and environmental pollution through leaching and volatization, respectively in long run. The disproportionate use of fertilizer has widened soil imbalance in terms of NPK ratio. In present situation of pressure, to increase productivity through high nutrient availability and management of costly inorganic fertilizer, it has now been realized that use of chemical fertilizers must be replaced through more economic, renewable and environmental friendly organic fertilizers, biofertilizers, crop residues and green manures. Thus, an integrated plant nutrient system aims at sustainable productivity with minimum deterioration effect of chemical fertilizers on soil health and environment. Thus, use of organic fertilizers with biofertilizers offers a great opportunity for sustainable fruit production in sweet orange.
Sweet orange respond very well to nutrient management. Due to high cost of inorganic fertilizers and increasing trend towards organic farming, use of organic fertilizers like Vermicompost, farm yard manures (FYM), neem cake and poultry manures occupies a significant place in today's agriculture. Recently, application of organic fertilizers in fruit crops has been increased due to their environmental friendly nature and good result.

## Material and Methods
The experiment was conducted at All India Coordinated Research Project on Fruits, Department of Horticulture, Mahatma Phule Krishi Vidyapeeth, Rahuri, Dist-Ahmednagar during the period 2013-14 to 2017-18. The statistical design applied for the experiment was Randomized Block Design with five treatments replicated four times. The plants of sweet orange cv. Mosambi were planted in medium black soil at a distance of 6 x 6 m.

Seventeen years old uniform sweet orange trees were selected for the experiment. Four trees were used for each treatment. *Ambia bahar* crop was taken in sweet orange where the water stress was induced in the months of November-December. Observations on growth, yield and fruit quality were recorded. Plant height was measured with the help of measuring tape. Canopy volume was calculated from the formula as suggested by Castle [4]. The fruit weight, number of fruits/tree and yield were recorded by following the standard procedure. Juice percentage was expressed as weight of juice out of the total fruit weight in percent. The total soluble solids (TSS) of the juice was recorded by using hand refractometer (Erma, Japan) having range of 0-32 ºBrix. Acidity was estimated by titrating juice with 0.1 N NaOH by using the method as suggested by AOAC [2]. The ascorbic acid, reducing sugars, non-reducing sugars and total sugars were estimated by the standard method described by Ranganna [11]. The data was statistically analyzed following the standard procedure given by Panse and Sukhatme [9].

**Treatment details:**

$T_1$: Control (800:300:600 g NPK + 20 Kg FYM + 15 Kg Neem cake/plant/year) + Inorganic plant protection.

$T_2$: 100% Vermicompost (On N-equivalent basis of RDF).

$T_3$: 75% Vermicompost (On N-equivalent basis of RDF) + *Trichoderma harzianum* (30-40 ml/plant) + Azadirachtin (1% at 3-4 ml/litre as spray).

$T_4$: 75% Vermicompost (On N-equivalent basis of RDF) + *Trichoderma harzianum* (30-40 ml/plant) + Azadirachtin (1% at 3-4 ml/litre as spray) + *Pseudomonas fluorescence* (30-40 ml/plant).

$T_5$: 50% Vermicompost (On N-equivalent basis of RDF) + *Trichoderma harzianum* (30-40 ml/plant) + Azadirachtin (1% at 3-4 ml/litre as spray) + *Pseudomonas fluorescence* (30-40 ml/plant) + *Azotobacter chroococcum* (30-40 ml/plant).

**Results and Discussion**

The pooled data (2013-14 to 2017-18) presented in Table 1 revealed that, the maximum plant height (3.40 m), fruit weight (197.47 g), number of fruits (292.12 fruits/tree) and yield (57.69 kg/tree and 15.97 t/ha) were recorded in treatment $T_4$ i. e. application of 75% Vermicompost (On N-equivalent basis of RDF) + *Trichoderma harzianum* (30-40 ml/plant) + Azadirachtin (1% at 3-4 ml/litre as spray) + *Pseudomonas fluorescence* (30-40 ml/plant). This application of vermicompost with biofertilizers to sweet orange trees effects on growth and yield by improving plant height, fruit weight, number of fruits/tree and yield as compared to other treatments. Vermicompost is finally divided peat like material with excellent structure, porosity, aeration, drainage and moisture holding capacity. Vermicompost supplies a suitable mineral balance and improves nutrient availability and could act as a complex fertilizer. Vermicompost with biofertilizers creates favorable environment for growing and growth of microbes thus its application was beneficial for growth and yield in sweet orange crop. Similar results were reported by Jain *et al.* 2012 [6] in Nagpur mandarin, Kovas *et al.* 2012 [7] in grape and Mokade 2015 [8] in Orange. There was non-significant difference between the treatments for canopy volume in sweet orange.

The pooled data (2013-14 to 2017-18) in respect of fruit quality presented in Table 2 showed that, the maximum juice (48.05%), TSS (10.00 ºBrix), ascorbic acid (55.32 mg/100 ml juice), reducing sugars (4.20%), non-reducing sugars (3.16%), total sugars (7.34%) with minimum acidity (0.46%) were also recorded in treatment $T_4$ i. e. application of 75% Vermicompost (On N-equivalent basis of RDF) + *Trichoderma harzianum* (30-40 ml/plant) + Azadirachtin (1% at 3-4 ml/litre as spray) + *Pseudomonas fluorescence* (30-40 ml/plant). This application of vermicompost with biofertilizers helped to improves the fruit quality of sweet orange by increasing soil structure and texture, porosity, aeration, drainage, water holding capacity of soil and growth of microbes. Similar results were reported by Ghosh *et al.* 2014 [5] in sweet orange, Babita *et al.* 2015 [3] in Orange and Pawar *et al.* 2017 [10] in sweet orange cv. Mosambi. There was non-significant difference between the treatments for shelf life of fruits in sweet orange.

The economics of various treatments of vermicompost and biofertilizers on benefit: cost ratio is presented in Table 3. The treatment $T_4$ i. e. application of 75% Vermicompost (On N-equivalent basis of RDF) + *Trichoderma harzianum* (30-40 ml/plant) + Azadirachtin (1% at 3-4 ml/litre as spray) + *Pseudomonas fluorescence* (30-40 ml/plant) was found superior and recorded the higher benefit: cost ratio (1.78) over rest of the treatments.

**Table 1:** Effect of vermicompost and biofertilizers on growth and yield in sweet orange (Pooled mean 2013-14 to 2017-18)

| Treatment | Plant height (m) | Canopy volume ($m^3$) | Fruit weight (g) | Number of fruits/tree | Yield (kg/tree) | Yield (t/ha) |
|---|---|---|---|---|---|---|
| $T_1$ | 3.11 | 23.44 | 184.14 | 231.29 | 42.63 | 11.80 |
| $T_2$ | 3.19 | 25.56 | 187.73 | 261.42 | 49.04 | 13.58 |
| $T_3$ | 3.29 | 27.46 | 195.03 | 276.41 | 54.01 | 14.95 |
| $T_4$ | 3.40 | 28.88 | 197.47 | 292.12 | 57.69 | 15.97 |
| $T_5$ | 3.18 | 24.97 | 187.94 | 248.38 | 46.62 | 12.90 |
| S. E. ± | 0.04 | 1.83 | 1.21 | 4.35 | 1.27 | 0.35 |
| C. D. at 5% | 0.12 | NS | 3.59 | 13.07 | 3.61 | 0.99 |

**Table 2:** Effect of vermicompost and biofertilizers on fruit quality in sweet orange (Pooled mean 2013-14 to 2017-18)

| Treatment | Juice (%) | TSS (ºBrix) | Acidity (%) | Ascorbic acid (mg/100 ml juice) | Reducing sugars (%) | Non-reducing sugars (%) | Total sugars (%) | Shelf life of fruit (Days) |
|---|---|---|---|---|---|---|---|---|
| $T_1$ | 42.18 | 9.65 | 0.59 | 47.92 | 3.46 | 2.06 | 5.52 | 15.17 |
| $T_2$ | 45.51 | 9.79 | 0.53 | 51.08 | 3.81 | 2.51 | 6.31 | 16.71 |
| $T_3$ | 46.95 | 9.89 | 0.51 | 52.81 | 3.90 | 2.86 | 6.76 | 18.38 |
| $T_4$ | 48.05 | 10.00 | 0.46 | 55.32 | 4.20 | 3.16 | 7.34 | 19.80 |
| $T_5$ | 44.52 | 9.64 | 0.55 | 49.85 | 3.68 | 2.45 | 6.13 | 17.20 |
| S. E. ± | 1.42 | 0.04 | 0.02 | 0.63 | 0.10 | 0.12 | 0.50 | 1.56 |
| C. D. at 5% | 4.28 | 0.13 | 0.06 | 1.90 | 0.31 | 0.38 | 1.50 | NS |

**Table 3:** Economics on the effect of vermicompost and biofertilizers in sweet orange (2017-18).

| Treatment | Total Expenditure (Rs/ha) | Yield (t/ha) Pooled mean | Gross monetary Return (Rs/ha) | Net profit (Rs/ha) | B: C ratio |
|---|---|---|---|---|---|
| $T_1$ | 1,96,217=75 | 11.80 | 2,59,600=00 | 63,382=25 | 1.32 |
| $T_2$ | 2,06,932=66 | 13.58 | 2,98,760=00 | 91,827=34 | 1.44 |
| $T_3$ | 1,93,493=94 | 14.95 | 3,28,900=00 | 1,35,406=06 | 1.69 |
| $T_4$ | 1,97,233=94 | 15.97 | 3,51,340=00 | 1,54,106=06 | 1.78 |
| $T_5$ | 1,67,501=38 | 12.90 | 2,83,800=00 | 1,16,298=62 | 1.69 |

Produce sold @ Rs. 22,000 / tonne.

## Conclusion

Considering five-year study of effect of vermicompost and biofertilizers on sweet orange, it was recommended that application of 75% Vermicompost (On N-equivalent basis of RDF) + Trichoderma harzianum (30-40 ml/plant) + Azadirachtin (1% at 3-4 ml/litre as spray) + Pseudomonas fluorescens (30- 40 ml/plant) in the month of January is recommended for better growth, yield, quality fruits and shelf life of fruits in *Ambia bahar* of sweet orange planted in medium black soils of Western Maharashtra.

## References


1. Anonymous. Horticulture statistics at a glance 2018, National Horticulture Database, 2018, 175-177.
2. AOAC. Official Methods of Analysis (6th Edn.), Association of Official Agricultural Chemists, Washington, DC, 1995.
3. Babita A, Ahmed N, Thakur M. Organic farming: A holistic approach towards sustainable fruit production. Ejpmr. 2015; 2(6):108-115.
4. Castle W. Growth, yield and cold hardiness of seven year old Bearss lemon on twenty seven rootstocks. Proc. Florida State Hort. Soc. 1983; 96:23-25.
5. Ghosh B, Irenaeus TKS, Kundu S, Datta P. Effect of organic manuring on growth, yield and quality of sweet orange. Acta Hort. 2014; 10(24):121-125.
6. Jain MC, Sharma MK, Bhatnagar P, Meena M, Yadav RK. Effect of mycorrhiza and vermicompost on properties of vertisol soil and leaf NPK content of Nagpur mandarin (*Citrus reticulata* Blanco). Asian J. of Hort. 2012; 7(2):528-532.
7. Kovas AB, Kremper R, Jakab A, Szabo A. Effect of farm yard manure and a bacterial fertilizer on the phosphorus and potassium content of grape leaves. Analete Universitatii Oradea, Fascicula protectia Mediului. 2012, 18.
8. Mokade PM. Effect of vermicompost on the growth of Indian orange (*Citrus reticulata* Blanco) with reference to its quality and quantity. Biosci. Biotech. Res. Comm. 2015; 8(2):217-220.
9. Panse VS, Sukhatme PV. Statistical methods for Agriculture Workers, 1989; ICAR, New Delhi.
10. Pawar PS, Datkhile RV, Bhite BR. Use of organic manures in sweet orange (*Citrus sinensis* Osbeck) cv. Mosambi. J. of Trends in Biosci. 2017; 10(14):2483-2486.
11. Ranganna S. Hand book of analysis and quality control for fruits and vegetables products. Tata McGraw Hill Publishing C Ltd, 1986; New Delhi, India.