

Original Research Article

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Role of Organic and Inorganic Sources of Nutrients on the Vegetative Growth, Yield and Quality of Sweet Orange (*Citrus sinensis* L.) cv. Sathgudi

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ABSTRACT

Keywords

NPK, Organic manures, Farm yard manure, Vermicompost, Biofertilizers

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The present investigation was carried out at Horticulture Research Station, Konda Mallepally, Nalgonda District, to study of the effect of different nutrients, organic manures and biofertilizers on the growth, yield and quality of sweet orange cv. Sathgudi. The results of investigation indicated that the maximum vegetative growth in terms of plant height (4.39 m), girth (48.50 cm), canopy spread –NS (4.35 m) and EW (4.33 m), number of fruits per tree (292.75), average fruit weight (159.75 g), yield (38.21 kg / plant), Juice (41.87 %) and TSS (9.04 °Brix) with treatment T₂ - NPK (300:70:80 g / tree) + Zn (0.5 %) + B (0.2 %) + Mn (0.1 %) + Mg (0.2 %) + Fe (0.2 %) and Lime (0.5 %).

Introduction

Sweet orange is one of the important fruit crops of citrus industry. The nutritional and economic importance makes sweet orange very popular all over the world. Adequate supply of nutrients is an important part of orchard management practice and fertilizer is one of the major input accounting for nearly 50 per cent of the cost of cultivation in sweet orange. Citrus plants not only requires major nutrients, it also requires minor nutrients like zinc, boron, magnesium, manganese, iron in

minute quantities for correction of micronutrient deficiencies. Continuous application of inorganic fertilizers causes problem to soil health and deteriorates soil microbial health.

A better understanding of soil and plant health is critical for maintaining the health of the plant and feeding the organisms that depend on soil (Morriessee *et al.*, 2004). Bio fertilizers play a vital role in improving soil health by fixing atmospheric nitrogen in association with plant roots. They solubilize

the insoluble soil phosphates and produces plant growth substances. They also help host plants against diseases and withstand stress conditions prevailed in the soil. They are cost-effective and play a vital role in reducing the inorganic fertilizer application and increases economic yields. Foliar application of micro nutrients increases the uptake of macro nutrients in the plant tissues and improves the vegetative growth, yield and quality in citrus plants. In present day scenario demand for quality produce requires a thorough knowledge on the relationship between macro, micro nutrients and crop physiology. Foliar micro nutrient sprays are important tool to enhance the production and productivity in fruit crops. As no work has been carried out in the state of Telangana in sweet orange crop, therefore the present work was undertaken to study the effect of organic fertilizers, manures and biofertilizers on vegetative growth, yield and fruit quality in sweet orange cv. Sathgudi.

Materials and Methods

The experiment was laid out during the year 2014 – 2019 with ten treatments and three replications with randomized block design (RBD) viz., T₁ - Recommended dose of NPK (300:70:80 g / tree), T₂ - T₁ + Zn (0.5 %) + B (0.2 %) + Mn (0.1 %) + Mg (0.2 %) + Fe (0.2 %) and Lime (0.5 %), T₃ - T₁ + Organic mulching with paddy straw (10 cm thick), T₄ - T₂ + Organic mulching with paddy straw (10 cm thick), T₅ - ½ RDF + 50 kg FYM + 250 g *Trichoderma*, T₆ - ½ RDF + 50 kg FYM + 250 g *Azospirillum*, T₇ - ½ RDF + 50 kg FYM + 250 g *Azotobacter* T₈ - ½ RDF + 50 kg FYM + 5 kg Vermicompost, T₉ - ½ RDF + 50 kg FYM + 250 g *Pseudomonas floescence*, T₁₀ - ½ RDF + 50 kg FYM + 250 g *Trichoderma* + 250 g *Pseudomonas floescence*. Chemical fertilizers were applied to the plant in two split doses – 50 % of N and P & 100 % K applied once after fruit harvest (August) and

another 50 % N and P at pre-bloom stage (November). Micro nutrient (Zn, B, Mn, Mg, and Lime) spray was done twice (one at new flush stage in the month of June and second spray in the month of January). Biofertilizers was incorporated in the plant basin in the month of October by thoroughly mixing with FYM along with inorganic fertilizers. Organic mulching was done with paddy straw (10 cm thickness) from the month of October till the harvest of fruits.

Fruit samples were collected in the last week of August. The observation on plant height, girth, canopy spread, number of fruits per tree, average fruit weight and yield (kg/tree) were recorded. The total soluble solids of the pulp for each treatment were recorded with the help of had refractometer of 0-30 (⁰Brix) range and expressed as per cent total soluble solids of the fruit (A.O.A.C.,1960). The acidity was determined by diluting the known volume of clear juice, filtered through a muslin cloth, with distilled water and titrating the same against standard sodium hydroxide solution, using phenolphthalein indicator. The result was expressed in terms of citric acid as per cent total titratable acidity of the fruit juice according to the method given in A.O.A.C. (1960). Ascorbic acid was estimated by 2,6 dichlorophenol dye method (Ranganna, 1977).

Results and Discussion

Vegetative growth parameters

Experimental data presented in Table 1 indicated significant differences among the treatments in respect of vegetative growth. Better growth of sathgudi plants was observed in treatment T₂ - NPK (300:70:80 g / tree) + Zn (0.5 %) + B (0.2 %) + Mn (0.1 %) + Mg (0.2 %) + Fe (0.2 %) and Lime (0.5 %), i.e., plant height (4.39 m), girth (48.50 cm), canopy spread –NS (4.35 m) and EW (4.33

m), number of fruits per tree (292.75), average fruit weight (159.75 g), yield (38.21 kg / plant), Juice (41.87 %) and TSS (9.04 °Brix). The increase in plant height, growth and canopy spread might be attributed to the combined application of major and micro nutrients to the sweet orange plants. Citrus

crop require widely zinc followed by boron, manganese, magnesium, copper and iron in minor quantities. Zinc is the important micro nutrient limiting the growth and yield in sweet orange. It is required for the synthesis of tryptophan, a precursor of auxin thus helps in growth and yield potential of a crop.

Table.1 Role of organic and inorganic sources of nutrients on vegetative growth in sweet orange cv. Sathgudi

Treatment	Plant height (m)	Plant girth (cm)	Canopy spread (m)	
			N-S	E-W
T ₁	3.70	48.30	4.13	4.14
T ₂	4.39	48.50	4.35	4.33
T ₃	4.10	43.91	4.02	4.14
T ₄	3.40	41.78	3.42	3.54
T ₅	3.56	36.80	3.44	3.70
T ₆	3.47	45.81	4.35	4.05
T ₇	3.16	46.96	4.15	4.08
T ₈	2.75	43.96	3.96	4.12
T ₉	3.59	42.84	4.30	4.06
T ₁₀	4.14	46.49	4.30	4.29
SE (m)	0.13	2.02	0.17	0.15
CD (0.05)	0.39	5.90	0.51	0.46

Table.2 Role of organic and inorganic sources of nutrients on yield and quality characters in sweet orange cv. sathgudi

Treatment	No. of fruits / tree	Average fruit weight (g)	Yield (kg / tree)	Juice (%)	TSS (°B)	Acidity (%)	Ascorbic acid (mg/ 100 ml)
T ₁	256.75	154.75	38.05	37.25	8.52	0.54	66.24
T ₂	292.75	159.75	38.21	41.87	9.04	0.67	70.85
T ₃	248.75	151.11	32.97	38.05	8.62	0.75	69.42
T ₄	244.50	156.37	33.48	41.68	8.97	0.72	70.67
T ₅	224.00	141.57	30.98	41.22	8.83	0.70	68.09
T ₆	241.00	149.89	32.99	40.98	8.89	0.71	65.29
T ₇	230.25	153.25	32.33	38.81	8.59	0.72	64.36
T ₈	228.75	151.75	30.37	35.97	8.85	0.73	65.33
T ₉	248.25	147.73	34.61	37.64	8.69	0.68	65.20
T ₁₀	244.50	154.50	35.41	41.86	8.43	0.73	70.11
SE (m)	7.29	3.16	1.25	0.98	0.13	0.02	1.66
CD (0.05)	21.28	9.22	3.65	2.87	0.39	0.07	4.85

In sweet orange, young leaves are usually the most affected and are small, chlorotic and rosetted due to the stunted short growth. These findings are supported by the results of Yadav *et al.*, (2007) who reported that 3 sprays (2nd week of May, last week of June and second week of August) zinc sulphate on sweet orange resulted in better growth and yield. Ram and Bose (2000) reported maximum plant height (43.76 cm) and stem girth (3.22 cm) with foliar application of 2% magnesium sulphate, 0.4% copper sulphate and 0.05% zinc, sulphate in mandarin orange. Ullah *et al.*, (2012) also reported that the foliar application of boron significantly increased the tree height, diameter, spread, flush length and leaf width in kinnow mandarin.

Fruit yield and quality parameters

The data presented in Table 2 show that the number of fruits per tree, average fruit weight (g) and yield (kg/tree) was significantly influenced by different treatments. The maximum number of fruits per tree (292.75 fruits / tree), average fruit weight (159.75 g) and fruit yield (38.21 kg/ plant) were also recorded with the treatment T₂ - NPK (300:70:80 g / tree) + Zn (0.5 %) + B (0.2 %) + Mn (0.1 %) + Mg (0.2 %) + Fe (0.2 %) and Lime (0.5 %). Similar observations was also noted by Gawande *et al.*, (1998) in lemon, Sharma *et al.*(2005) in litchi. Singh *et al.*, (2005) in papaya, Goswami *et al.*, (2012) in guava and Bakshi *et al.*, (2013) in strawberry. Basal and foliar spray of macro and micro nutrients resulted in vigorous vegetative growth and this favoured the strong sink towards photosynthetic activity of the plants and greater synthesis of carbohydrates, amino acids and other nucleo proteins. These complex compounds were responsible for better yields and quality in sathgudi plants. Vegetative growth and yield attributes are highly correlated with the external supply of

nutrients which enhanced the nutrient availability to the plants.

The data in respect of quality parameters was presented Table 2. The influence of different treatments also showed significant differences in quality attributes of sweet orange fruits. The fruit quality parameters in terms of juice percent, TSS, ascorbic acid, were significantly enhanced by different nutrients, organic manures and biofertilizers application. The maximum juice percent (41.87 %) and TSS (9.04 °Brix) and ascorbic acid (70.85 mg / 100 ml) recorded in treatment T₂ - NPK (300:70:80 g / tree) + Zn (0.5 %) + B (0.2 %) + Mn (0.1 %) + Mg (0.2 %) + Fe (0.2 %) and Lime (0.5 %). Increase in total soluble solids, juice percent and ascorbic acid content in the fruits might be attributed to the involvement of nitrogen and potassium in synthesis of various amino acids, which increase the metabolic process in the fruits and consequently increased the quality.

Based on the above results, it can be concluded that, to increase vegetative growth, yield and quality of sweet orange cv. sathgudi application of NPK (300:70:80 g / tree) along with Zn (0.5 %) + B (0.2 %) + Mn (0.1 %) + Mg (0.2 %) + Fe (0.2 %) and Lime (0.5 %). Chemical fertilizers (NPK) were applied to the plant in two split doses – 50 % of N and P & 100 % K applied once after fruit harvest (August) and another 50 % N and P at pre-bloom stage (November). Micro nutrient (Zn, B, Mn, Mg, and Lime) spray was done twice (one at new flush stage in the month of June and second spray in the month of January).

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