

Original Research Article

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Effect of Micronutrients on Growth, Vigour and Fruit Weight of Nagpur Mandarin (*Citrus reticulata Blanco*) in Satpura Plateau Region, India

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ABSTRACT

Micro nutrient play important role for better growth, Vigour flowering and fruiting in citrus tree. Micronutrient deficiency is wide spread in the existing orchards. In this investigation, effect of micro nutrients on growth, vigor and fruit weight of Nagpur Mandarin (*Citrus reticulata Blanco*) in Satpura Plateau. Experiments were conducted in Jawaharlal Nehru Krishi Vishwa Vidyalaya, Zonal Agriculture Research Station, Mohagaon Farm, Sausar Block of Chhindwara District of Madhya Pradesh during 2015 with varying in soil properties and agro-climatic conditions. Plants at both sites were subjected to foliar spray. The spray was applied twice: once at pea stage and gravel stage. There were 15 treatments for foliar spray of Zn, Cu, Fe and Mo in combinations. Foliar application of CuSO₄ (0.4 % Spray) at pea stage and gravel stage increased the fruit retention to the extent of 46 % as compared to control 23 % only.

Keywords

Citrus, Foliar Spray, Micronutrients, Fruit retention.

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Introduction

Citrus fruits are commercially important since pre- independence period in India. In central India mainly Viddarbha region of Maharashtra and adjoining parts of Madhya Pradesh, Nagpur Mandarin (*Citrus reticulata Blanco*), an easily peel able orange locally called as “Santra” is commercially grown since last 100 years. Records of cultivation of this mandarin in this region are available from late nineteenth century as well. Nagpur Mandarin is famous world over for its fine flower that develops in agro- climatic condition of central India especially in Vidarbha and adjoining Chhindwara region of Madhya Pradesh.

The nutrition constitutes an important component of successful and healthy citrus cultivation. An inadequate nutrition leads to the improper growth and reduced productivity of the citrus trees. The mineral nutrients are composed of major and micro- nutrients. Among the major nutrients, N, P and K are the primary nutrients and are required in large amount while, Ca, Mg and S are the secondary nutrients and most of them are supplied to the trees along with the primary nutrients through the synthetic fertilizers (Singh and Khan 2012). The micronutrients on the other hand though are required in small amount but play a great role in plant metabolism (Katyay, 2004; Kazi *et al.*, 2012).

These are involved in the synthesis of many compounds essential for plant growth and productivity and are the activators for various enzymes. For instance, Zn is involved in the biosynthesis of Tryptophan, a precursor of naturally occurring auxin, indole acetic acid (IAA) (Swietlik, 2002), Mn is required in the process of photosynthesis (Mengel and Kirkby, 1987) and Fe plays a key role in several enzyme-systems, in which haeme or haemin is the prosthetic group (Khurshid *et al.*, 2008). The main sources of micronutrients are parent material, sewage sludge, fungicides, farmyard manure and also present in small amount in soil (Nafees, 2009; Awad and Romheld, 1993). Micronutrients deficiency is common in peach orchards and fruit trees in Peshawar (Tariq, 2008). Soil and climatic factors affecting the availability of micronutrients including: pH, soil water content, organic matter, nutrients interaction, temperature and light. The DTPA and AB-DTPA extractable Zn, Cu, and Fe decreases with increasing soil pH (Khattak, 1994). Soil test is of limited value for orchards where roots penetrate 1–2 m in the soil and samples are taken from surface soil (30cm) in most cases and do not represent the fertility status of the lower depths where the roots are feeding. Therefore, plant analysis is commonly accepted as being the most reliable guide for evaluating the success of the orchard's fertility program (Basar, 2006). However, the micronutrients content in the leaves usually does not indicate the status of micronutrients in plant (Abadia, 2000; Razeto and Valdes, 2006).

Materials and Methods

A field study was conducted on Jawaharlal Nehru Krishi Vishwa Vidyalaya, Zonal Agriculture Research Station, Mohagaon Farm, Sausar Block of Chhindwara District of Madhya Pradesh during 2015-16. Twenty Five trees were selected for the trial. Each tree was considered as an individual treatment in

the experiment. 15 treatments with four replications were applied. The spray was applied twice: once at pea stage and gravel stage with object of experiment effect of micro nutrients on growth, Vigor and fruit weight of Nagpur Mandarin (*Citrus reticulata Blanco*) in Satpura Plateau Region. There were 15 treatments for foliar spray of Zn, Cu, Fe & Mo in combinations as per detailed as, ZnSO₄ (0.4 % Spray); ZnSO₄ (0.5 % Spray), A/M (0.05 % Spray), A/M (0.1 % Spray) FeSO₄ (0.4 % Spray), FeSO₄ (0.5 % Spray), CuSO₄ (0.4 % Spray), CuSO₄ (0.5 % Spray), ZnSO₄ (0.4 % Spray) + A/M (0.05 % Spray), FeSO₄ (0.4 % Spray) + A/M (0.05 % Spray), CuSO₄ (0.4 % Spray) + A/M (0.05 % Spray), ZnSO₄ (0.4 % Spray) + CuSO₄ (0.4 % Spray), ZnSO₄ (0.4 % Spray) + FeSO₄ (0.4 % Spray), CuSO₄ (0.4 % Spray) + FeSO₄ (0.4 % Spray) and Control. The experiment was laid out in randomized block design and replicated thrice. Foliar applications were given during the months of March and April. Statistical Analysis Data were subjected to analysis of variance and differences among treatments evaluated through Statistics 8.1.

Results and Discussion

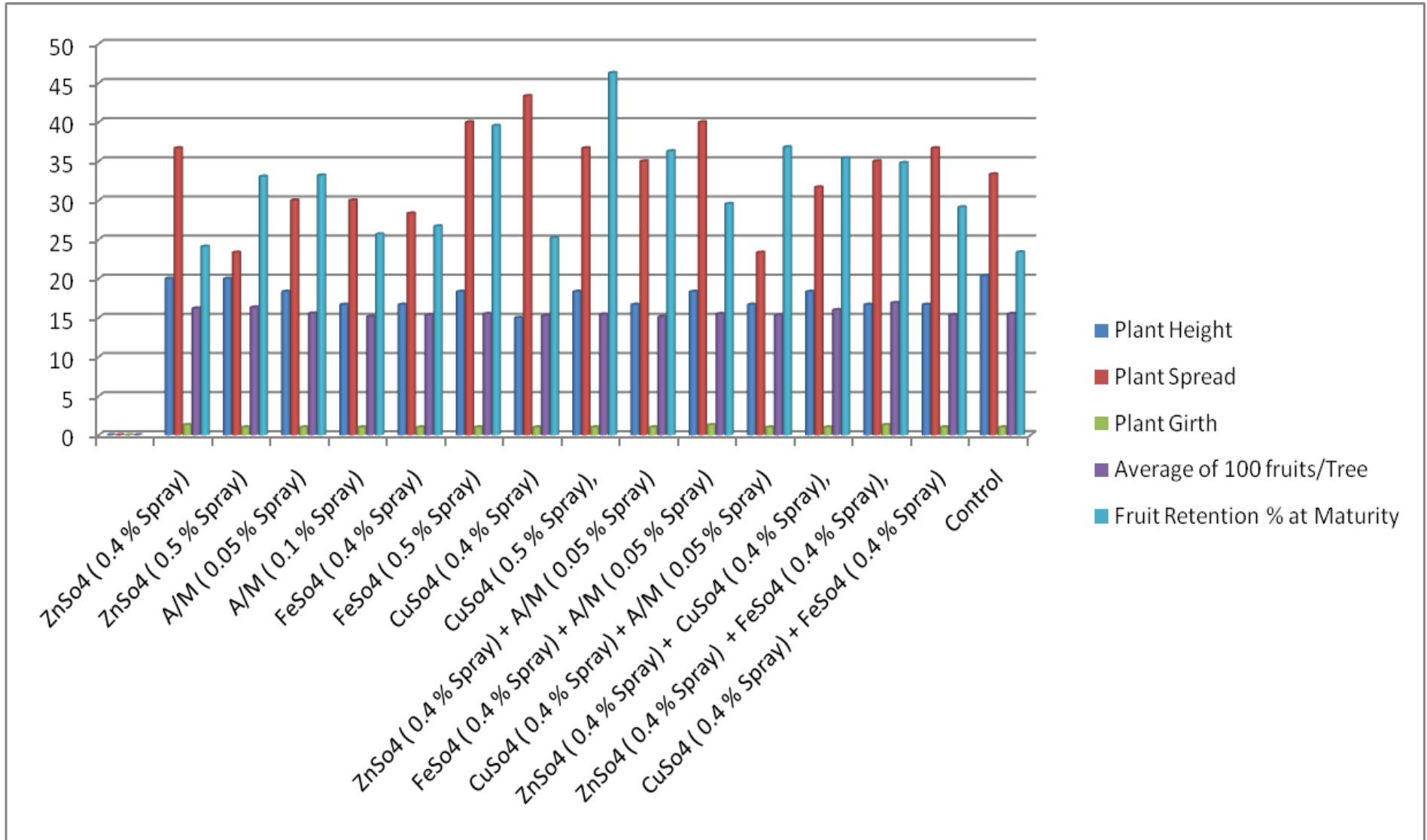
Foliar application of micronutrients (Zn, Cu, Fe & Mo) significantly affected on the growth, Vigor and fruit weight of Nagpur Mandarin which showed increasing trend with increase in levels of micronutrients with few exceptions (Table 1).

The data were statistically analyzed and significant difference is observed on fruit retention due to micronutrients CuSO₄ (0.5 % Spray) application at pea stage and gravel stage recorded the highest 46.28 % fruit retention while FeSO₄ (0.5 % Spray) and CuSO₄ (0.4 % Spray) + Ammonium Molybdate (0.05 % Spray) recorded 39.54 and 36.81 % retention respectively. In control retention to is 23.37 percent only.

Table.1 Effect of different micronutrients on growth yield and fruit retention % in Nagpur Mandarin

S.No	Treatment	Plant Height cm	Plant Spread cm	Plant Girth cm	Average of 100 fruits/Tree kg	Fruit Retention % at Maturity
01	ZnSO ₄ (0.4 % Spray)	20.00	36.67	1.3	16.20	24.09
02	ZnSO ₄ (0.5 % Spray)	20.00	23.33	1.0	16.33	33.05
03	A/M (0.05 % Spray)	18.33	30.00	1.0	15.56	33.20
04	A/M (0.1 % Spray)	16.67	30.00	1.0	15.13	25.68
05	FeSO ₄ (0.4 % Spray)	16.67	28.33	1.0	15.33	26.69
06	FeSO ₄ (0.5 % Spray)	18.33	40.00	1.0	15.50	39.54
07	CuSO ₄ (0.4 % Spray)	15.00	43.33	1.0	15.26	25.23
08	CuSO ₄ (0.5 % Spray),	18.33	36.67	1.0	15.43	46.28
09	ZnSO ₄ (0.4 % Spray) + A/M (0.05 % Spray)	16.67	35.00	1.0	15.10	36.28
10	FeSO ₄ (0.4 % Spray) + A/M (0.05 % Spray)	18.33	40.00	1.3	15.50	29.55
11	CuSO ₄ (0.4 % Spray) + A/M (0.05 % Spray)	16.67	23.33	1.0	15.30	36.81
12	ZnSO ₄ (0.4 % Spray) + CuSO ₄ (0.4 % Spray),	18.33	31.67	1.0	16.00	35.39
13	ZnSO ₄ (0.4 % Spray) + FeSO ₄ (0.4 % Spray),	16.67	35.00	1.3	16.90	34.80
14	CuSO ₄ (0.4 % Spray) + FeSO ₄ (0.4 % Spray)	16.67	36.67	1.0	15.33	29.13
15	Control	20.33	33.33	1.0	15.50	23.37
	SEm _+	3.51	4.51	0.325	0.176	2.06
	C.D. at 5 %	NS	NS	NS	NS	5.95
	C.V. %	34.48	0.233	58.64	3.38	11.15

Fig.1 Plant height (cm), plant spread (cm), plant girth (cm) average weight of 100 fruits per tree (kg) and fruit retention % at maturity



Fruit Retention Percent at Maturity the varied significantly by the application of micronutrients. Fruit Retention Percent at Maturity increased with the application of micronutrients and significantly higher (one tree / replication / Treatment) was obtained with the foliar application of micronutrients over control in CuSO₄ (0.5 % Spray) and flowed in combination of foliar application of CuSO₄ (0.4 % Spray) + Ammonium Molybdate (0.05 % Spray). However, maximum Average weight of 100 fruits per tree (Kg) was obtained with the foliar application of ZnSO₄ (0.5 % Spray), ZnSO₄ (0.4 % Spray) followed by ZnSO₄ (0.4 % Spray) + FeSO₄ (0.4 % Spray).

Micro nutrient play important role for better growth, Vigour flowering and fruiting in citrus tree. Micronutrient deficiency is wide spread in the existing orchards. The concentration of micronutrients in the plant height (cm), plant spread (cm) plant girth (cm) average weight of 100 fruits per tree (Kg) and fruit retention % at maturity revealed that whether the specific micronutrients are received or not. None of the micronutrient showed the same level in all treatments. But fruit retention % at maturity and average weight of 100 fruits per tree (kg) that the micronutrients were adequate in all the treatments after spray. These results showed that leaf analysis is a best tool for the evaluation of micronutrients in orchards.

In conclusion, Foliar application of CuSO₄ (0.4% spray) at pea stage and gravel stage increased the fruit retention to the extent of 46% as compared to control 23% only.

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