EFFECT OF MICRONUTRIENTS APPLICATION ON THE YIELD AND QUALITY OF KINNOW MANDARIN (*CITRUS RETICULATA* BLANCO.)

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Abstract

Effect of micronutrients on fruit yield and quality of Kinnow mandarin was studied at Horticultural Research Institute, Faisalabad, Pakistan, during the year 2002-04. The effect of micronutrients on yield and fruit quality indicates that the highest yield (1406 fruit/plant), weight (233.75 gm/fruit), size (L/B-7.65/7.42cm), and juice percentage (50.13%) were noted in T_4, where 60 gm each of $CuSO_4$, $MnSO_4$, $FeSO_4$ and 100 gm of $ZnSO_4$ were applied to the plants. The same treatment also produced maximum TSS (12.30%). The control trees produced fruits of maximum peel thickness (0.60 cm), peel percentage (30.50%) and acidity (0.71%). The lowest acidity (0.60%) and peel thickness (0.43cm) were recorded in T_3, where 60 gm each of $CuSO_4$, $MnSO_4$, $FeSO_4$ and 75 gm of $ZnSO_4$, were applied.

Keywords: Kinnow (*Citrus reticulata* Blanco), Micronutrients, yield and quality

Introduction

Citrus is the most important fruit crop of the World. In Pakistan, it has the largest area amongst all fruits and is grown on 194200 thousand hectares with 1830300 thousand tonnes of fruit production. Punjab alone contributes 95% of area and 96% of fruit production.

Micronutrient play an important role at all stages of plant development. They are essential to plant growth particularly because they function as essential constituents for various enzyme systems. Micronutrients are needed by the plants in minute quantity but, these are indispensable.

When a citrus tree is unable to obtain sufficient supplies of these essential nutrients, either because of insufficient quantity present in soil or non-availability to the plant due to some other reasons, the tree and fruit manifest a number of deficiency symptoms. Replacement of soil nutrients by fertilization is principally directed to restore the health of the vegetative parts of the plant and to improve fruit yield. However, direct as well as indirect evidences show that fertilization also affects the nutrient contents and quality of the citrus fruit. Catara (1987) reported the existence of Mg, Mn, Fe and Zn deficiencies in citrus orchards of the country. Rodriguez *et al*., (1994) reported that the micronutrients were supplied with foliar application of 0.6% $ZnSO_4$ (22% Zn) + 0.6% urea in Dec. or Dec. + Mar., or with 0.35% Zineb (19% Zn) in Dec. Control received no foliar Zn treatments. All plants received standard N, P, Ca and Mg fertilizer applications. Monthly foliar analysis showed that in control, leaf Zn concentrations remained fairly stable (15-40 ppm) through out the year. The lowest concentrations were associated with (Feb-Mar. and Oct.-Dec.). Foliar Zn application increased leaf Zn concentration from critical to normal or

high values, depending on treatment, but fruit yield and size were not affected.

The present project was carried out to study the effect of micronutrients as a soil application which could increase yield and improve fruit quality in citrus/Kinnow mandarin.

Materials and Methods

The present studies were conducted at Horticultural Research Institute Faisalabad, for the improvement of yield and quality of Kinnow, during the year 2002-04.Forty kinnow plants of 25 years age apparently of the same age and vigor were selected for this purpose. The experiment was laid out according to randomized complete block design with four replications. The standard doze of NPK (1000: 500: 500 gm) were applied to the plants. The following micronutrient treatments were tested:

T_1: $CuSO_4$, $MnSO_4$, $FeSO_4$ and $ZnSO_4$ (20gm each).
T_2: $CuSO_4$, $MnSO_4$, $FeSO_4$ and $ZnSO_4$ (40gm each).
T_3: $CuSO_4$, $MnSO_4$, $FeSO_4$ (60gm each) + $ZnSO_4$ (75 gm)
T_4: $CuSO_4$, $MnSO_4$, $FeSO_4$ (60gm each) + $ZnSO_4$ (100 gm)
T_5: Control. (No micronutrient application)

Half doze of nitrogen (500 gm) and full doze of P& K (500 gm each) were applied in February and remaining half doze of nitrogen (500 gm) was applied after fruit setting in mid April. Micronutrients were applied during mid April and 1st week of September. Data on yield were recorded during the month of October in both the years and that on fruit quality i.e. fruit weight, size, peel thickness, juice percentage, peel percentage, TSS and acidity, during the month of February, each year.

Data were processed and analysis of variance (ANOVA) was carried out, based on randomized complete block design, using MSTATC, a P.C. based programme. at p=0.05.

Results and Discussion

Fruit Yield, Weight and Size

The effect of micronutrients application on yield and size of fruit was statistically significant while, non-significant for weight of fruit (Table-1). The results show that the highest yield (1406 fruits/plant), weight (233.75 gm/fruit) and size (L/b- 7.73/7.65 cm) were noted in T_4, where 60 gm each of $CuSO_4$, $MnSO_4$, $FeSO_4$ and 100 gm of $ZnSO_4$ were supplied, followed by T_3 where 60 gm of each of $CuSO_4$, $MnSO_4$, $FeSO_4$ and 75 gm $ZnSO_4$ were used, yielding 1348 fruits/plant, with 232.50 gm weight, and size L/b-7.65/7.42 cm. The lowest yield (1120 fruits/plant), weight (212.50 gm/fruit) and size (L/b 7.11/7.11 cm) were noted in T_5 (control), where no micronutrient was applied to the plants. Ram and Bose, (2000) revealed the effect of Mg and micronutrients on yield and fruit quality of mandarin. The Mg and micronutrients except Cu resulted in higher fruit yield than the control. Maximum fruit yield was reported with application of Mg+Cu +Zn. Micronutrients also influenced fruiting potential (yield and yield components). Zn + ETDA was best to increase both the number and weight of fruits per tree (Sourour-MM, 2000). Micronutrients i.e. 75 ppm Fe, 50ppm Mn, or 75 ppm Zn alone or in combinations reduced fruit drop and increased yield (Hassan-AK, 1995).

Peel thickness, Juice and Peel percentage.

The results regarding the peel thickness and juice percentage were significant and the effect of micronutrients on peel percentage was non-significant (Table-1). The highest juice percentage (50.13%) was found in T_4 and it was minimum (39.38 %) in T_5 (control). The lowest peel thickness (0.43 cm) was found in T_3 while peel percentage was (26.75%). Was highest T_5 (control) i.e. peel thickness 0.60 cm and peel percentage (27.0%) in T_1. Application of Mg, Cu, Zn and Fe and B, in combination, increased the juice content (Ram and Bose, 2000). Mn-EDTA and $ZnSO_4$ treatments had the lowest peel thickness in both seasons. Fruit juice volume, extracted from fruits of trees treated with Fe, Zn, and citrus wuxal was higher than in control treatments in (Sourour-MM, 2000). The maximum juice and total soluble solids were found in fruits from the trees sprayed with 1.0 and 0.8% urea and Zinc sulphate, respectively (Malik *et al*., 2000).

Total Soluble Solids (TSS), and Acidity.

The results (Table-2) indicate the highest TSS (12.30%) in T_4 followed by T_3 and T_2, where TSS was 11.75% and 11.29%, respectively. T_5 (control) had the lowest TSS (10.63%) and the highest acidity (0.71%). T_3 produced the lowest acidity (0.60%). The Fruit juice of trees sprayed with Fe, Mn, and Zn (Chelating form) contained significantly higher TSS% than control (Sourour-MM., 2000).

Table 1: Effect of micronutrients application on yield, weight, size, peel thickness juice and peel percentage of Kinnow mandarin

Characters		**Treatment means (2002-2003 to 2003-2004)**					
		T_1	**T_2**	**T_3**	**T_4**	**T_5**	**LSD**
Yield (no. of fruits/plant)		1240 b	1315 ab	1348 ab	1406 a	1120 c	109.3**
Fruit weight (g)		218.12	225.0	232.50	233.75	212.50	N.S
Fruit size (cm)	Breadth	7.064 b	7.338 ab	7.65 a	7.73 a	7.11 b	0.448*
	Length	7.22 b	7.33 ab	7.42 ab	7.65 a	7.11 b	0.334*
Peel thickness		0.49 b	0.46 bc	0.43 c	0.44 c	0.60 a	0.0461**
Juice percentage		42.25 cd	45.50 bc	48.75 ab	50.13 a	39.38 d	3.429**
Peel percentage		26.0	28.50	26.75	27.0	30.50	N.S

Table2: Effect of micronutrients application on total soluble solids and acidity of Kinnow mandarin

Characters	Treatment means (2002-2003 to 2003-2004)					
	T_1	T_2	T_3	T_4	T_5	LSD
Total soluble solids (%)	1094 c	11.29 bc	11.75 ab	12.30 a	10.63 c	0.786**
Acidity (%)	0.67 b	0.65 b	0.60 c	0.62 c	0.71 a	0.326**

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