EFFECT OF ZINC FOLIAR SPRAYS ON YIELD AND FRUIT QUALITY OF ORANGE TREES

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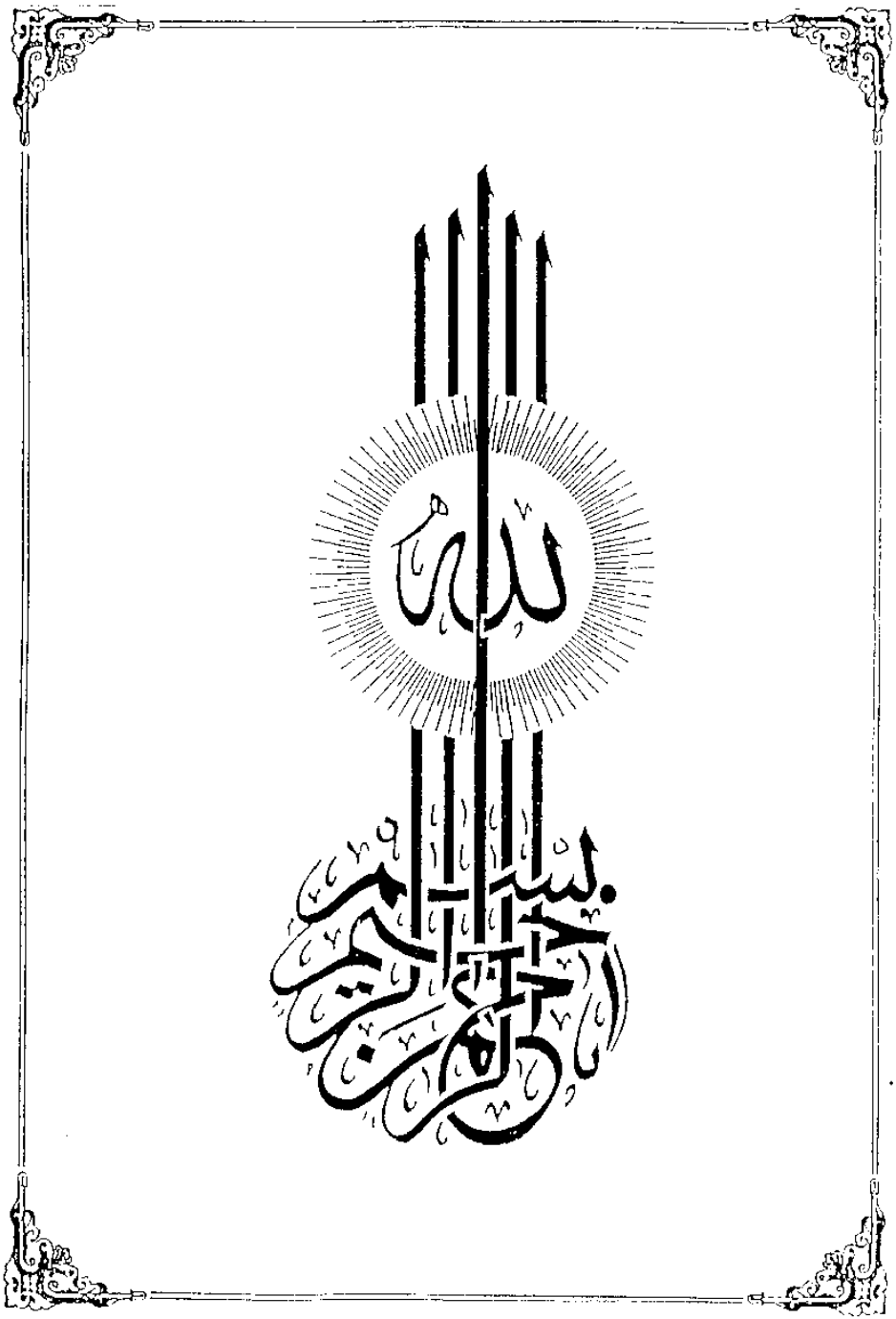

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C O N T E N T S

to meet the problem of dificit or unavailability of some nutrient elements in soils.

This study deals with one of the "Washington Navel" orange orchards located at Sharkia Governorate which showed some visual zinc difficiency symptoms. The main goal is to study the effect of some zinc foliar application on leaf mineral content of trees. Moreover, the effect of such foliar sprays on the yield and fruit quality was also investigated.

REVIEW OF LITERATURE

EFFECT OF ZINC FOLIAR SPRAYS ON MINERAL CONTENT OF CITRUS LEAVES:

Zinc is one of the essential micro-elements in plant nutrition. The symptoms of little or mottled leaf in orange were explained as zinc defficiency which was corrected by spraying zinc compounds such as $ZnSO_4$ and ZnO (Johnsion, 1933; Ruehle, 1940 and Reuther & Smith, 1950).

EFFECT OF MINERAL ZINC SPRAYS:

Bertrand (1935) found that spraying $ZnSO_4$ improved both the assimilation of soil N and the translocation of N by plant.

On orange, Labanauskas et al. (1963) found that foliar application once a year of 1 pound ZnO (75% Zn, per 100 gallons of water) corrected Zn deficiency symptoms on sprayed leaves of spring flush of "Valencia" orange, but failed to prevent symptoms from developing on the subsequent new spring flush of leaves. Manchanda (1967) sprayed sweet orange trees (3-year-old) for two years by Zn alone or in combination with Cu or Mn or Fe, found that chlorosis was considerably decreased and the health of sprayed trees was greatly improved. Labanauskas (1968) found that foliar application with 0.1% $ZnSO_4$ corrected Zn deficiency symptoms and increased Zn, Mn and Na concentrations in the leaves of "Valencia" orange trees, whereas it decreased the levels of

N, Ca, Mg and Cu. Similarly, increased the leaf contents of Zn, Mn and B in "Navel" orange, whereas the leaf Cu content did not increased. Ibrahim and Ali (1970) reported that foliar sprays of zinc sulphate at 4 lb/100 gal. of water raised the Zn level from 19 to 33 ppm and significantly increased N content in "Pineapple" orange leaves. Also, Garcia Alvarez et al. (1983) found that spraying orange trees with $ZnSO_4$ (0.23 kg/378.5 litres water), improved the leaf colour (70 and 60 days after application in the first and second year, respectively).

On lemon, Embleton et al. (1965) indicated that the leaves of "Eureka" lemon trees which received 1 lbs $ZnSO_4$ (36% Zn per 100 gallons of water), contained significantly more Zn than leaves of untreated check. Jones et al.(1973) studied the response of young lemon trees to zinc application. They reported that leaf Zn was low but one annual foliage spray of $ZnSO_4$ supplied adequate Zn and there was no response to additional Zn spray.

On mandarin, Dixit et al. (1979) found that $ZnSO_4$ sprays at concentrations ranged from 0.5 to 1.0% increased Zn leaf content of "Kinnow" mandarin trees, but other nutrient levels were not affected. Dixit and Yamdagni (1983) found that foliar application of $ZnSO_4$ at 1% on "Kinnow" mandarin reduced chlorosis.

On grapefruit, Chanchal et al. (1977) mentioned that $ZnSO_4$ sprays on "Duncan" grapefruit trees increased Zn leaf content.

EFFECT OF SPRAYING WITH MINERAL ZINC AND SOME OTHER COMPOUNDS:

On orange, Manchanda et al. (1971) found that in a 5-year trial foliar sprays of 0.5% Zn and/or 0.4% each of Cu, Mn and Fe increased the quantities of the respective elements in sweet orange leaves.

Barnard et al. (1973) found that spraying various mixtures of Zn, Mn, B, Cu and Mo satisfactorily increased the leaf contents of Zn, Mn and B in "Navel" orange, whereas the leaf Cu content did not increased. Kaira and Nauriyal (1973) reported that chlorotic trees of sweet orange showed equally good response to foliar sprays of 0.4% $ZnSO_4$ and 0.4-0.6% dithane Z-78. Labanauskas et al. (1973) studied the effect of micro-nutrient sprays containing the precipitating agent Na_2CO_3 with $ZnSO_4$, $MnSO_4$ and $CuSO_4$. He found that when Na_2CO_3 was omitted from the spray, application of 1 lb/100 gal. each of Zn or Mn corrected the respective deficiency symptoms and produced no observable injury on "Washington Navel" orange. Also, Sharma et al. (1974) indicated that spraying sweet orange trees with 0.5% $ZnSO_4$ + 1% urea reduced chlorosis and stimulated growth. Similarly, Manchanda (1974) found that spraying sweet orange trees with $ZnSO_4$ and urea reduced chlorosis and decreased the phosphorus leaf content of the treated trees.

On mandarin, Nijjar and Brar (1977) working on "Kinnow" mandarin, found that spraying 4 kg zinc sulphate + 2 kg hydrated lime in 1000 litres water in July increased Zn leaf content and had a little effect on N, P, K, Fe and Mn levels. Ranvir Singh and Misra (1980) reported that spraying "Kinnow" mandarin trees with $ZnSO_4$ at 0.5% + borax at 0.2% in April, July and September enhanced the tree condition and reduced the shoot diback and chlorosis.

EFFECT OF CHELATED ZINC SPRAYS:

Chanchal et al. (1977) mentioned that spraying "Duncan" grapefruit trees by Zn-EDTA significantly increased Zn leaf content as compared with the control. Similarly, Khadr et al. (1978) found that the foliar application of 100 ppm Zn-EDTA increased Zn leaf content of "Washington Navel" orange.

EFFECT OF SPRAYING WITH CHELATED ZINC AND SOME OTHER COMPOUNDS:

Taha et al. (1979) reported that Zn-EDTA + urea sprays on "Washington Navel" orange and "Balady" mandarin trees markedly increased Zn concentration and caused Fe reduction in the sprayed leaves. El-Gazzar et al. (1979) studied the response of "Washington Navel" orange to foliar applications of chelating zinc, manganese, iron and urea. They found that Zn concentration increased in leaves sampled 4 or 6 months after spraying compared with the untreated control. Similarly, El-Shazly (1981) working on "Valencia" orange, who found that spraying with Zn-EDTA+ urea at (0.5-1.0 pound Zn-EDTA + 6.0 pound urea per 100 gallon water) increased N, Zn, Mn, Cu, B & Al leaf content, but decreased the P, K, Ca, Mg & Fe levels

but Na level was not affected. Also, Sabour (1981) found that Zn-EDTA + urea sprays significantly increased K, Zn and Cu but decreased P, Ca, Mg, Mn, Fe and B leaf content of "Valencia" orange.

EFFECT OF CHELATED OR MINERAL ZINC SPRAYS:

Dube and Saxena (1971) sprayed sweet orange trees by Zn-EDTA at 0.25% or $ZnSO_4$ at 0.5% for controlling Zn chlorosis, He found that the Zn-EDTA was the more effective in respect of N, Fe and Zn uptake. On the other hand, Leonared and Myer (1973) noted that foliar application of orange trees either by ZnO (at 6.9 lb Zn/acre) or with Zn chelated (at 0.7 lb Zn/acre) reduced Zn chlorosis in the spring and the ZnO sprays was more effective than Zn chelated on enhancing the green colour in September.

EFFECT OF ZINC FOLIAR SPRAYS ON CITRUS YIELD

EFFECT OF MINERAL ZINC SPRAYS:

Zinc sulphate application improved the blossom ability of grapefruit and "Washington Navel" orange trees and increased the yield by 26% compared with the control (Reed & Parker 1936 and Parker 1936 & 1937).

On orange, Ali et al. (1955) found that foliar sprays of $ZnSO_4$ three times per year to "Pineapple" orange trees decreased June drop by 4.5%. Sahota and Arora (1981) indicated that foliar application with $ZnSO_4$ at 0.6% in

February and April increased the yield of "Hamlin" sweet orange as compared with untreated trees. On the contrary, Labanauskas et al. (1963) indicated that foliar application of Zn at 1 lb ZnO (75% Zn) slightly decreased the yield of "Valencia" orange as compared with the control. Also, Labanauskas et al. (1972) indicated that spraying with $ZnSO_4$ (0.25-2.0 lb/100 gal.) on "Washington Navel" orange trees slightly decreased yield.

Meanwhile, Labanauskas (1968) reported that 0.1% $ZnSO_4$ did not affect the "Valencia" orange yield. Similarly, Manchanda et al. (1972) found that foliar application of Zn at 0.5% on sweet orange did not affect the yield. Also, Bacha (1975) showed that four sprays with 300 ppm $ZnSO_4$ had no effect on fruit yield of "Succary" and "Balady" orange trees.

On lemon, Embleton et al. (1965) noted that the yield of "Eureka" lemon trees was increased by annual spray application in spring with $ZnSO_4$ and this increase was paralleled by increasing the Zn levels in the treated trees. Moreover, Pachuliya (1972) found that applied Zn on lemon trees in the spring increased the yield.

On mandarin, Samolads (1965) reported that spraying mandarin trees by Zn increased yield by 20%. Dixit et al. (1978) mentioned that spraying $ZnSO_4$ at 1% in April and September on "Kinnow" mandarin trees enhanced the yield.

On grapefruit, Chanchal et al. (1977) reported that foliar application with $ZnSO_4$ increased yield of "Duncan" grapefruit trees. On the contrary, Leyden and Laduke (1984) found that foliar sprays with $ZnSO_4$ had no effect on yield of grapefruit.

EFFECT OF SPRAYING WITH MINERAL ZINC AND SOME OTHER COMPOUNDS:

On orange, Sharma et al. (1974) indicated that 0.5% $ZnSO_4$ + 1% urea sprays increased the yield of orange trees.

On mandarin, Quintela (1964) mentioned that spraying in winter at six-weekly intervals with solutions of Zn, Mn, Cu and S increased the yield of Citrus reticulata by 30-68%. Talakvadze (1973) reported that spraying young mandarin twice with urea at 1% + Zn at 0.1% increased the yield by 1.3% compared with the control. Nijjar and Brar (1977) working on "Kinnow" mandarin, found that spraying with $ZnSO_4$ (0.4%) of 4 kg zinc sulphate + 2 kg hydrated lime in 1000 litres water in July increased the yield. Casu et al. (1980) found that spraying with NPK + Cu + Zn + Fe + Mn + B vitamins + NAA increased yield of Clementine trees by 29%.

EFFECT OF CHELATED ZINC SPRAYS:

Chanchal et al. (1977) working on "Duncan" grapefruit, found that foliar application with Zn-EDTA increased the yield compared with the control. Also, Khadr et al.,(1978) indicated that foliar application of 100 ppm Zn-EDTA increased the yield of "Washington Navel" orange trees.

EFFECT OF SPRAYING WITH CHELATED ZINC AND UREA:

El-Shazly (1981) working on "Valencia" orange trees, found that spraying with 1 lb Zn-EDTA + 6 lb urea in 100 gallon water, increased the yield by 52% over the control.

EFFECT OF ZINC FOLIAR SPRAYS ON FRUIT QUALITY

EFFECT OF MINERAL ZINC SPRAYS:

On orange, Labanauskas et al. (1968) working on "Valencia" orange trees, reported that foliar application of ZnO at 1 lb/ 100 gallon water increased the amount of ascorbic acid in fruits, but decreased the percent of juice as compared with the untreated trees.

On the other hand, Manchanda (1967) indicated that foliar application of Zn + Cu on sweet orange increased fruit juice, T.S.S., reducing sugar and ascorbic acid contents. Fichera and Darrigo (1975) showed that Zn application had a positive effect on flavonoids and ascorbic acid contents of orange fruits. Sahota and Arora (1981) working on "Hamlin" sweet orange trees, indicated that one or two sprays with $ZnSO_4$ at 0.6% increased individual fruit weight and diameter.

Meanwhile, Labanauskas (1968) found that foliar application of 0.1% $ZnSO_4$ did not affect fruit quality of "Valencia" orange. Similarly, Bacha (1975) indicated that foliar four sprays with 300 ppm $ZnSO_4$ and/or 250 ppm $CuSO_4$ had no effect on fruit quality of "Succary" and "Balady" oranges.

On mandarin, Dixit et al. (1977) found that spraying "Kinnow-A" mandarin hybrid with $ZnSO_4$ at 1% in April and September increased fruit size, juice, T.S.S. ascorbic acid and total sugar contents.

EFFECT OF SPRAYING WITH MINERAL ZINC AND SOME OTHER COMPOUNDS:

Sharma et al. (1974) working on chlorotic sweet orange trees, found that spraying with $ZnSO_4$ at 0.5% and urea at 1% increased fruit weight and size. Also, Nijjar and Brar (1977) working on "Kinnow" mandarin, found that spraying with $ZnSO_4$ (0.4%) of 4 kg zinc sulphate + 2 kg hydrated lime in 1000 litres water in July increased fruit weight and size.

Meanwhile, Casu et al. (1980) found that spraying with NPK + Cu + Zn + Fe + Mn + B vitamins + NAA increased the T.S.S. concentration in the fruit of "Clementine" trees.

EFFECT OF CHELATED ZINC SPRAYS:

Khadr et al. (1978) indicated that foliar application of 100 ppm Zn-EDTA improved fruit quality of "Washington Navel" orange.

EFFECT OF CHELATED OR MINERAL ZINC SPRAYS:

Dube & Saxena (1971) working on the effect of spraying Zn-EDTA at 0.25% or $ZnSO_4$ at 0.5% on sweet orange for controlling Zn chlorosis, found that the effect of Zn-EDTA was higher than zinc sulphate in respect with fruit colour, texture, size and juice quality.