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Sweet Orange Decline in Relation to Soil Plant Nutrition Status. – A Review

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Abstract: *A overview of work done on the sweet orange decline in relation to soil and plant nutritional status in Jalna district of Maharashtra contributing to sweet orange decline, soil fertility was found one of the major constraint induced by soil pH, salinity and calcium carbonate etc. Nutrients like nitrogen, phosphorus, potassium, ferrous, magnese, zinc and boron were of major significance in sweet orange decline and should be a part of fertilizer application on a regular basis. Nutritional content in order of their increasing or decreasing influence on fruit yield, quality and would further help to evolve a more purposeful nutrient management and there by counter sweet orange decline effectively.*

Keywords: - *Sweet orange decline, soil factors, plant factors, nutritional status.*

I. Introduction

Sweet orange decline in relation to yield and quality are occurs in Jalna district day by day. The various factors and nutritional disorders may be one of contributing factors to sweet orange decline studied conducted in Marathwada region indicated that large scale maltinutrient deficiencies were responsible for the decline in productive sweet orange orchards (Srivastava & Singh, 2004). An overview of work done in sweet orange decline with reference to soil and plant nutritional status aspects are reviewed below:

1) Soil Factors

The condition of the soil plays a major role in determining the success or failure of sweet orange plantation. Soil physical properties related constraint clay gradient in soil profile, drainage, irrigation , water logging and soil fertility constraint induced by soil pH, salinity,$CaCO_3$ besides increasing means of nutrient decreasing are the important pedological factor contributing to sweet orange decline (Srivastava & Singh, 2009). Chief soil constraints are reduced soil depth due to slicing of fertile layer, exposure to water stress curtailed available water capacity, low soil air temperature, low cation exchange capacity, deficiency of nitrogen, phosphorus, potassium, toxicity of aluminum and magnesium in addition to non competitive iron toxicity induced zinc deficiency (Shrivastava and Singh, 2006).

a) Soil reaction (pH)

Soil reaction has a marked influenced on soil environment, especially, on the availability of the plant nutrients. The citrus trees were found declining at high soil pH i.e. 9.5 and above where as high soil acidity is a widespread constraint on yield and fruit quality in Sao Paulo, Brazil(Quaggio et al. , 1992)

b) Electrical conductivity (EC)

Electrical conductivity under both healthy (0.12 – 0.20 dSm-1) and declining (0.12-0.26 dSm-1)trees likewise showed no significant difference and were well within critical limit of 0.9 -1.7 dSm-1 (Shrivastava & Singh, 2004,2009). Mass (1992) suggested a decrease in Satsuma yield at the rate of 13% for each 1.0dSm^{-1} increase in the EC of saturated soil extract beyond the threshold EC limit of 1-4 dSm^{-1}.

c) Calcium Carbonate ($CaCO_3$)

$CaCO_3$ affect physic- chemical characteristics of soil. The availability of nutrients was found to be releated with $CaCO_3$ content in the soil which leads to chlorosis in citrus (El- Azhar et al., 1980; Nilangekar & Patil, 1981) No significance difference was observed with respect to CaCO3 under healthy trees (28.00-142.0gkg/ha) vs declining trees (22.0-112.0gkg/ha). Soil $CaCO_3$ content under healthy trees registered comparatively higher values over declining trees. Such observation needs to be viewed from the angle of strong association of $CaCO_3$ nodules with micronutrient containing minerals and in due course of time, these trapped nutrients were released and were added to the available pool of nutrients (Shrivastava & Singh, 2001,2004)

d) Organic Carbon(OC)

Maintaining a high level of organic carbon in the soil increased the citrus growth (El- Azhar et al.1980). the citrus trees generally declining due to low organic carbon (Nilangekar & Patil, 1981a,b; Chavan et al.,1984; Sharma et al., 1986)

2) Plant Nutrient factors (N,P,K)

The quantity of nutrient elements removed by fruits from the soil, denoted importance of nutrition. In Punjab(Datta et al.,1988) reported that a yield 40 tonnes/ha of kinnow mandarin removed 96 kg N, 10.80 kg P and 78.80 kg K per ha from soil annually. The total annual deplation of plant food is even higher if losses due to leaching and erosion are taken into consideration. Nutrients like N, P, K, Ca, Mg, Fe, Mn, Cu, Zn, and B showed a significant variation when their nutrient status in healthy vs declining trees were compared. Macronutirents and leaf micronutrients were significantly higher in healthy trees than decling trees (Shrivastava & Singh,2006,2009)

a) Nitrogen (N)

Deficiency of nitrogen, appeared an young leaves become undersigned, thin and fragil and develop a light green colour also reduces the growth rate and fruit production of plant.

Soil factors (viz. exchangeable Ca2+ and Na+) and suboptimum levels of N, P, K, Ca, Fe, Mn, Zn and B both in the soil and leaf proved to be important contributory factors towards citrus decline (Shrivastava & Singh,2009)

There is considerable evidence to show that increasing application of nitrogen significantly reduces the concentration of P and K in leaves. However nitrogen depressed K at low but note at high soil K levels both in leaves and roots (Smith et al.,1954).

b) Phosphorus (P)

Excessive leaf drop at the time of spring bloom and twing dieback are indicators phosphorus deficiency. Young citrus trees deficient in P shows reduce growth and the older leaves loose their deep green colour and luster. A higher level of P in the soil was found to be related with citrus decline (Nijjar and Singh, 1971), where as low to medium P was attributed to mandarian decline in Himachal Pradesh (Sharma and Mahajan,1990) Ko and Kim (1987) observed that high yielding orchards had high mineral content, but low in available P.

c) Potassium (K)

The dwarfing, curling and puckering of leaves, gummosis and chlorosis of branches and per mature dropping of fruits are the symptom of K deficiency.

A high level of leaf K was found to be associated with declined citrus trees (Arora et al.,1981; Reddy and Sharma,1982;Ahlwat et al.,1982; Watscher, 1983; and Vamdagni et al., 1983). K was significantly lower under declining trees (6.4 me $100g^{-1}$) compared with healthy trees (8.0 me $100g^{-1}$) reported by Shrivastava and Singh (2004)

Higher K associated with lower concentration of Fe, Mn and Zn is common in the rhizosphere soil of blighted trees than those of healthy trees (Pavan and Watscher, 1993).

d) Iron (Fe)

A good correlation has been found between iron content and chlorophyll. Iron plays an important role in electron transport system of the plants.

The low availability of iron in soil was found more citrus decline. The excess of iron in the soil also the casual factor of citrus decline. Yadav et al.,(1997) observed iron deficiency more pronounced in monsoon flushes vs. spring flushes of Nagpur mandarin. Deficient foliar contents of iron were associated with the decline of citrus trees (Reddy and Sharma,1982). Wutscher (1983) observed higher folier levels of iron in citrus trees affected with blight.

e) Zinc (Zn)

The availability of zinc in soil is controlled by chemical properties of soil and its deficiency affect the plant growth. The deficiency of the zinc in soil was observed to cause decline in citrus (Ouyang et al.,1984; Raina, 1988; Sharma and Mahajan,1990). Zinc deficiency has been associated with citrus decline. Elevated Zn accumulation took place prior to visual symptom in 58% of the trees developing blight, and 32% of these trees, zinc accumulation took place three years before appearance of zinc deficiency symptoms (Wutscher et al., 1982)

f) Manganese (Mn)

Manganese deficiency or excess in soil cause growth reduction in plants. The Mn deficiency was most comman in declined trees (Reddy and Sharma, 1982; Wuwet et al.,1998) where as Mn level was found higher in decline trees (Coelho et al., 1984;Sharma et al., 1986).

g) Copper (Cu)

Copper is an oxidizing agent in soil as well as in plants. Copper is an essential micro nutrient for plant growth. Low level of foliar Cu Contents were found to be associated with citrus decline (Wuwel et al., 1998) and many workers reported that higher level of Cu in declined than in healthy citrus trees (Prasad et al.,1981; Yamdagni et al., 1983). The effect of Cu on the growth of Hamlin Orange trees was more pronounced at soil pH range of 5.5 – 6.0 than at higher or lower soil pH. (Alva et al.,1995).

3) Plant Growth, Yield and quality -

Nutritional imbalance caused disorder and affects the plant growth like shoot length, number of leaves per shoot, percent drying of shoot, fruit size, fruit weight, fruit yield and quality. In citrus decline observed that, shoot dieback and stunted growth of plants leading to reduce tree canopy (Azari,1981). The decline percent varies with age of orchard, type of soil, nutrition, water stress (Diwari and Kolte, 1990) The leaf area of plant has a direct bearing on the vigour and yield quality of the plant. In citrus, blight affected trees are fewer the less number of leaves and sallerr leaves than the healthy one. (Syvertsen et al.,1980).The health and vigour of the plant is directly affected on fruit size, fruit weight and yield.

The fruit yield and quality on healthy trees was higher than decline trees (Dey and Singha,1998).

Fruit quality i. e. TSS%, Juice% and acidity and ascorbic acid is directly related to nutritional status of soil and plant of the orchard. TSS and Juice % was higher of the fruits on healthy trees than fruits on decline trees. The acid content of the juice in terms of citric acid showed significant variation in fruit of healthy and decline trees. Ascorbic acid content was almost same of the juice of the fruits from healthy and decline trees (Huchche,1999)

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