Article: RT0369

Biotica Research Today

Vol 2:10 1031/1033

2020

Citrus Decline in Coorg Mandarin: Soil and Nutrient Management Aspects

Rajendiran S.* and Chandrakant M. Awachare

Central Horticultural Experiment Station (CHES), ICAR-IIHR, Chettalli, Kodagu, Karnataka (571 248), India

Open Access

Corresponding Author

Rajendiran S

e-mail: Rajendiran.S@icar.gov.in

Keywords

Citrus decline, Coorg mandarin, Nutrient deficiency, Soil management

How to cite this article?

Rajendiran and Awachare, 2020. Citrus Decline in Coorg Mandarin: Soil and Nutrient Management Aspects. Biotica Research Today 2(10): 1031-1033.

Abstract

Citrus decline is a major problem of Citriculture in India and is caused by combined effects of many biotic and abiotic factors. Coorg mandarin is an ecotype grown in Southern India mainly Karnataka, Tamil Nadu and Kerala. Area and production of Coorg mandarin are drastically come-down during the last three decades due to citrus decline. Sub-optimal crop management, unavailability of quality planting materials, nutrient deficiencies, poor soil, water, nutrient and drainage management, pest and disease incidences are major reasons for citrus decline. Coorg mandarin is not given much attention as cultivated along with coffee and pepper plantations which resulted in reduction of average yield of a plant from 50 kg to less than 10 kg. This article mainly focuses on soil and nutrient related constraints in Coorg mandarin and suitable corrective measures to improve plant and soil health of Coorg mandarin orchards for sustaining the production.

Introduction

Mandarin (*Citrus reticulata* Blanco), most important fruit of citrus family, is mainly grown in Maharashtra, Madhya Pradesh, West Bengal, Karnataka, Tamil Nadu and North-Eastern States. In South India, an ecotype of mandarin known as 'Coorg Mandarin' is quite popular and is being widely cultivated for several decades. It is grown in Kodagu, Hassan, Chikmagalur districts of Karnataka, Wayanad district of Kerala, Shevaroy and Palani hills of Tamil Nadu. This crop is largely grown in rainfed condition as one of the components crop in coffee and pepper plantations. Coorg oranges have greenish-yellow fruits with tight skin, blend of sweet and sour taste, and longer shelf life compared to other mandarins. Because of this specific taste and nature the Coorg mandarin was given geological indication status during 2006. The total mandarin production in Karnataka is 46,250 tonnes with productivity of 25 t ha^{-1}. Mandarin is planted for more than 150 years with an area of 24,000 ha in Kodagu district and now mandarin area has come down to less than 2,000 ha due to citrus decline. Citrus decline is caused by complex biotic and abiotic factors such as improper soils, unavailability of virus free quality planting materials, nutrient deficiencies, mal-practices in nursery, diseases and insect pests, improper cultural practices, lack of proper nutrition and plant protection measures, poor drainage, etc. Due to citrus decline, the average yield of a plant has come down from 50 kg to 10 kg. These complex issues need to be addressed through interdisciplinary effort. In this context, Central Horticultural Experiment Station, Chettalli has worked out the integrated multidisciplinary approaches like development of disease free quality planting material, proper orchard management, correction of nutrient deficiencies and soil test based optimal nutrient management practices, adaption of various pest and

Article History

Received in 14th October 2020

Received in revised form 18th October 2020

Accepted in final form 19th October 2020

E-mail: *bioticapublications@gmail.com*

disease control measures (Anonymous, 2009). However this article mainly focus nutritional and soil management aspects for sustaining Coorg mandarin production.

Major Soil and Nutrient Related Constraints of Coorg Mandarin

Area under Coorg mandarin has drastically decreased during the last three decades. The area under Coorg mandarin in 1960 was around 50,000 acres which is reduced to less than 5000 acres presently. Coorg mandarin cultivation in Kodagu region is under considerable biotic and abiotic stresses. The common problems are deterioration of plant health and poor productivity after 8-9 years age. There are several factors responsible for the decline of Coorg mandarin. The major soil and nutrient related problems are appended below:

Improper Soils

Soils in Kodagu region are mainly sandy loam, sandy clay loam, and clay loam with slightly to highly acidic. Because of heavy rains (1500-2000 mm), most of the bases and nutrients are leached or eroded in runoff water, causes soils less fertile. Further high acidity may cause Al toxicity and affects root growth and plant health. Further formation of subsurface hardpans interfere root penetration. Under these circumstances, though soil has high levels of Fe, Zn, Mn, and Cu, their uptake is hindered due to improper root growth.

Improper Cultural Practices

Improper crop spacing causes high shading, deprives the mandarin trees for sun light and competition for water and nutrients cause slow growth, low flowering and fruiting. Improper intercultural practices particularly during basin cleaning, hoeing and fertilizer incorporation lead to damage of roots as 80% of active roots of Coorg mandarins are distributed with in the 60 cm soil depth. The damaged roots are very conducive for attack of pest and diseases and affect the nutrient uptake.

Multiple Nutrient Deficiencies in Soil

Coorg mandarin is grown in hilly areas with high rainfall. Soils of this zone are mostly acidic and availability of some of the secondary and micronutrients is low. Further the recommended doses of fertilizers are seldom given to the mandarin trees. Therefore the deficiency of nitrogen, phosphorus, potassium, zinc, magnesium, and boron is prevalent in most of the Coorg mandarin orchards affect vegetative growth, yellowing of leaves, poor flowering and fruit-set.

Soil Moisture Stress (Excess or Deficit)

Coorg mandarin is grown as rainfed crop. Most of the Coorg mandarin growing areas receive higher rainfall ranging from 1000 mm to 3000 mm during June-October and thereafter a dry season prevails from January-May. High soil moisture during rainy season resulted in leaching of nutrients results yellowing and weakness of leaves and *Phytopthora* root rot infection. Improper drainage and water stagnation for quite long period in Coorg mandarin orchards causes rotting of roots and decay of plants. Conversely prolonged low moisture in soil during summer adversely affects plant growth and nutrient uptake.

Best Soil and Nutrient Management Practices for Coorg Mandarin

Proper Orchard Management

The improved production technology of Coorg mandarin has different components:

- Use of standardized rootstocks for Coorg mandarin based on their adaptability to various kinds of soil, resistance/ tolerance to various diseases and higher fruit quality. Rangpur lime, trifoliate orange, rough lemon rootstocks are found suitable.
- Proper tree spacing with two rows of coffee at 2.8 m × 2.8 m and one row of Coorg mandarin at 5.5 m × 5.5 m was found most profitable. Root density was higher in wider spacing than in close spacing, resulting in better tree-vigour and higher yield per unit area.
- Regulation of shading is very important. Proper shading improved soil pH, organic carbon and exchangeable cations, but excess shading reduced vigour and productivity of Coorg mandarin.
- Proper intercultural operations such as hand weeding, shallow scuffing and mulching; and no disturbance 1-2 m around the trees are good.

Appropriate Soil Management Practices

As soils in the region are highly acidic, proper soil management practices are inevitable to improve the soil and plant health. They are,

- Soil application of lime or dolomite to increase pH of soil to the level that is suitable for Coorg mandarin.
- Appropriate erosion control measures to avoid run-off losses of soils and nutrients.
- Application of organic manures (25 kg FYM per plant + 5 kg neem cake) is also recommended to improve soil carbon content and microbial activity.
- Application of bio-fertilizers such as Arka Microbial Consortium (AMC) and Vesicular-Arbuscular Mycorrhiza (VAM) are also beneficial in improving root and plant growth, and solubilising and mobilising nutrients from soil.

Water Management and Proper Drainage

Water requirement of Coorg mandarin is different in growth and reproductive phases. To avoid moisture stress during growth phase, irrigation at 10 days

interval from March-April is beneficial in sustaining the vigour of plants. However, in the reproductive phase, irrigation should be given as blossom shower either through sprinkler or drip irrigations (18-20 L of water per day per plant for one week) during March-April and thereafter supportive irrigations to ensure sufficient soil moisture for retention and enlargement of fruits. Mulching the basins with dry leaves during summer conserves soil moisture. Effective drainage of rain water is necessary in rainy season to minimize the damages arising from the development of soil-borne diseases.

Integrated Nutrient Management

Plant nutrition management is one of the most important factors governing yield potential in Coorg mandarin. In Kodagu region, the continuous cultivation of citrus plant with little or no replenishment of nutrients often resulted in multi-nutrient deficiency. Therefore, balanced application of nutrients through constant monitoring of leaf nutrient concentration along with soil analysis is essential to rejuvenate and increase yield of Coorg mandarin orchards. Optimum range of leaf nutrient concentration for budded and seedlings plants of Coorg mandarin is presented in table 1.

Table 1: Optimum ranges of leaf nutrient concentration in budded and seedling plants of Coorg mandarin (Anjaneyulu, 1984)

Nutrient	Optimum range	
	Grafted plants	Seedlings
N (%)	1.82 - 2.72	1.51 - 3.37
P (%)	0.15 - 0.63	0.19 - 0.61
K (%)	1.15 - 2.06	1.02 - 2.14
Ca (%)	0.73 - 2.44	0.92 - 3.74
Mg (%)	0.17 - 0.32	0.21 - 0.53
Fe (ppm)	43.2 - 171	56.0 - 229
Mn (ppm)	14.0 - 73	23.0 - 151
Zn (ppm)	13.0 - 36	38 .0 - 131

Application of 600 g N, 200 g P_2O_5 and 400 g K_2O per tree per year in two splits during May-June and September-October is recommended for optimum growth and productivity of Coorg mandarin. In case of severe Zn and Mg deficiency, soil application of 500-1000 g zinc sulphate along with 200 g calcium chloride per plant once in 3-4 years and two foliar sprays of 0.25% zinc sulphate annually; similarly soil application of 500-1000 g dolomite or 250 g magnesium sulphate per plant every year followed by two foliar sprays of 0.5% magnesium sulphate are recommended. Also foliar application of Arka Citrus Micronutrient Special during flowering and fruit setting is beneficial. If soils are found to be deficient to any nutrient(s), soil application of that nutrient along with foliar spray is important for improving soil and plant health. In Figure 1, the healthy and the citrus decline affected plants of Coorg mandarin are presented for comparison.

Figure 1: Healthy and citrus decline affected plants of Coorg mandarin

The efficient nutrient management along with pests and disease management are important for rejuvenation of Coorg mandarin. The old and declining trees should be pruned by removing of dried, dead wood and symptomatic shoots to a level free from such symptoms followed by pasting of cut ends with 10% Bordeaux paste. Soil application of 25 kg FYM + 5 kg Neem cake + 150 g *Trichoderma harzianum* + 400 g N, 125 g P_2O_5 and 275g K_2O in two splits (pre and post-monsoon) + 1 kg dolomite twice (June and October) should be done. The foliar application of 200 g N, 75 g P_2O_5 and 125 g K_2O through soluble fertilizer, Zn (0.2%), magnesium sulphate (0.5%) and calcium chloride/nitrate (0.5%) once a month coupled with integrated management of *Phytophthora*, powdery mildew and citrus vectors resulted in improve the tree vigour and yield of declining Coorg mandarin orchards (Ravishankar *et al.,* 2007).

Conclusion

Citrus decline is of a complex nature involving more than one factor and causes drastic yield reduction from 50 kg to less than 10 kg in Coorg mandarin. Sub-optimal management of Coorg mandarin in mixed cropping system is a major reason. This can be addressed through supply of virus-free planting material, proper nursery management, planting, orchard management, nutrition, selection of suitable rootstock, and timely plant protection measures. Efficient integrated soil, plant, water and nutrient management along with appropriate pest and disease control will help in sustainable production of Coorg mandarin orchards.

References

Anjaneyulu, 1984. Effect of NPK in chlorosis, growth and leaf mineral composition of Coorg mandarin. Andhra Agricultural Journal, 31, 246–248.

Anonymous, 2009. Diamond Jubilee Publication of Central Horticultural Experiment Station, Chettalli, Indian Institute of Horticultural Research, Bangalore,. 72.

Ravishankar, H., Sakthivel, T., Samuel, D.K., Raghupathi, H.B., Gopalakrishna, P., Karunakaran, G., 2007. Improved Technology for Coorg Mandarin Production. Central Horticultural Experiment Station, Chettalli, 12.