

Role of Micronutrients in Fruit Crops

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SUMMARY

Micronutrients play a major productive and qualitative role in bringing stability and sustainability in the production system. Even though micronutrients are used by plants in very small amounts, they are just as essential for plant growth as large as amounts of primary and secondary nutrients. They must be maintained in balance in order for all nutrients and water to be used efficiently. Micronutrients play important role in the keeping up the growth, yield and quality of fruit crops. The requirements of micronutrients (Boron, Iron, Copper, Zinc, Manganese and Molybdenum) is only in traces, which is partly met from the soil or through chemical fertilizers or through other sources. Proper plant nutrition is essential for successful production of fruit crops. Integrated supply of micronutrients with macronutrients in adequate amount and suitable proportions is one of the most important factors that control plant growth on fruit crops. Fruits like Mango, Banana, Papaya, Citrus, Pomegranate, etc. are highly susceptible to various disorders caused by deficiency of micronutrients. Hence judicious application of micronutrients may prove to be an effective tool for sustainable fruit production.

INTRODUCTION

Micronutrients are key elements in plant growth and development. These elements play an important role in various enzymatic activities and synthesis. Their acute deficiencies some time poses the problem of incurable nature. These micronutrients also help in the uptake of major nutrients and play an active role in the plant metabolism process starting from cell wall development to respiration, photosynthesis, chlorophyll formation, enzyme activity, hormone synthesis, nitrogen fixation and reduction (Das, 2003). Micronutrients play vital role in the keeping up the growth, yield and quality of fruit crops. Micronutrients enhance the overall acceptability of the fruit crops by alleviating the quality characteristics of the fruits. Though immediate deficiencies of micronutrients may not be noticeable, yet plants have been shown to have a hidden hunger for micronutrients and of that fulfilled. Yield is the basic component of a crop growth management system especially if it is a fruit crops.

The major causes for micronutrients deficiencies are intensified agriculture practices, unbalanced fertilizer application including NPK, depletion of nutrients and no replenishment. Horticultural crops suffer widely by Zinc deficiency followed by boron, manganese, copper, iron (mostly induced) and molybdenum deficiencies. Mo, Cu, Fe and Mn are involved in various processes related to photosynthesis and Zn, Cu, Fe and Mn are associated with various enzyme systems; Mo is specific for nitrate reductase only. B is the only micronutrient not specifically associated with either photosynthesis or enzyme function, but it is associated with the carbohydrate chemistry and reproductive system of the plant. The sufficient amount of micronutrients necessary for better plant growth which resulted in higher yield due to increase growth, better flowering and higher fruit set (Ram and Bose, 2000).

The improvement in quality of fruit might be due to the catalytic action of micronutrients particularly at higher concentrations. Hence, the foliar application of micronutrients quickly increased the uptake of macronutrients in the tissue and organs and improves fruit quality. Foliar micronutrients is one tool to maintain or enhance plant nutritional status during the growing season. Micronutrients, apart from providing the necessary nutrition for quality improvement also are used for disease prevention. One of the most common micronutrients based pesticides is the copper-based pesticide which is the most common product used as a preventive control of disease in fruit crops. The available information regarding the impact of micronutrients on fruit crop is scanty. Based on this background, the role of micronutrients and its effect on different fruit crops are as follows.

Table 1. Important micronutrients and their essential role in fruit crops:

Micronutrients	Role
Boron	<ul style="list-style-type: none"> • Important in cellular functions • Essential for pollen germination and tube growth
Copper	<ul style="list-style-type: none"> • Constituent of oxidase enzymes • Metal component of some proteins (helps with electron transfer)
Iron	<ul style="list-style-type: none"> • Important for electron transport in some enzymes • Associated with enzymes in chlorophyll formation
Manganese	<ul style="list-style-type: none"> • Involved in oxidation/reduction in photosynthesis • Accelerates germination and maturity
Molybdenum	<ul style="list-style-type: none"> • Very important to the plant if form of Nitrogen be taken up is nitrate (NO₃) helps it to ammonium (NH₄) • Important component of legume nodule
Zinc	<ul style="list-style-type: none"> • Needed for producing chlorophyll • Improves root development, flowering and fruit production

(Mahaveer *et. al*)**Mango**

Mango trees suffer widely by the deficiency of micronutrients. If these are corrected at proper time, it definitely boosts up the economic the tree. The major nutritional disorder in mango is little leaf caused by the deficiency of Zinc. This leads to stunted growth of roots, shoots and leaves. The lamina of leaves turn pale yellow while midrib remain green. Leaves become very small, little with interveinal chlorosis. Yellowing, necrotic patches develop on old leaves with drying of leaves. Subsequently necrotic patches turn grey and cover the entire surfaces.

Two sprays of 1-2 % Zinc sulphate, one at the time of flowering and the other at one month after the first spray correct this disorder. These symptoms resembles Boron deficiency in some conditions, remedy is spraying of 0.2 % boric acid. Tip burning of old leaves with grey brown patches is the typical symptom of copper deficiency. Spraying of 0.3 % copper sulphate checks the disorder effectively. It is reported that spraying of Fe (0.1%) reduced spongy tissue in mango. Pre-harvest application of Ca(NO₃)₂ @ 1.0% which improved yield, quality and shelf life of mango cv. Dashehari (Bhatta *et. al.*, 2008). Gujar *et al.*, (2015) reported that the foliar application of 1% ZnSo₄, 1% FeSo₄ and 0.5 % Borax in combination significantly influenced flowering in terms of minimum days taken to 50% flowering, increased length of panicle, number of fruit set at pea and marble stage, number of fruits per tree, average fruit weight and yield per tree compared to other treatments and control.

Banana

Banana requires more nutrients than any other community cultivated crop and various nutritional disorder affecting the yield and quality of banana have been reported. Iron deficiency is comparatively very rare in banana plantation. However, foliar spray of 0.2-0.5% ferrous sulphate checks the disorder effectively. Zinc is the most commonly reported deficiency in banana plantations. Spraying of Zinc sulphate 0.3% + 0.5% urea at 45 and 60 days after planting of main crop and 45 days after cutting of mother plant corrects the disorder well (Jeyakumar, 2013).

Recent studies suggest that combined foliar spray of Zn (0.5%), Fe (0.2%), Cu (0.2%) and B (0.1%) influenced morphological, physiological and yield attributes. The treatment had significant improvement in bunch yield and quality parameters by showing higher total soluble solids and lower acidity.

Citrus

Micronutrients are equally important for the quality characteristics of citrus in terms of juice content, TSS and other quality parameters. Balanced plant nutritional management along with sound phyto-sanitary

managements strategies based in cupric fungicides use are essentials to achieve highest yield of citrus fruits. To evaluate the effect of micronutrients on control of fruit drop in citrus, foliar application of Zinc, K, salicylic acid on citrus fruit reduced the fruit drop by 30 % and also helpful in increasing the yield(Sattar, 1990).

Zinc when used in conjunction with EDTA increased both the number of fruits per tree as well as yield per tree. Application of micronutrients like Fe and Zn led to increased juice content in citrus fruits. Photosynthetic efficiency of citrus plants is enhanced with the application of Manganese (Mn).

Papaya

The nutrition of papaya differs from other fruit crops because of its quick growth, continue fruiting habit and high fruit yield.it is therefore, essential combination on plant growth, yield and fruit quality for their commercial application. Micronutrient disorder are comparatively rare in papaya but zinc and boron deficiencies are commonly observed in the orchards where papaya is grown continuously. Foliar spray of Zn (0.5%) + B (0.1%)at 4th and 8th month after planting increased the fruit yield, quality of the fruits was improved in terms of TSS, total sugars, reducing sugars content significantly. Foliar application of ferrous sulphate 0.15% at monthly intervals from fifteen days after planting improved the total sugars and TSS of Papaya (Kavitha, 2000).

Pomegranate

Pomegranate is one of the most important commercial fruit is eaten fresh and also processed for jams, jellies, syrups, pomegranate juice products and is used for medical purposes. The fruit peel, tree stem, root bark and leaves are good source of secondary metabolites such as tannins, dyes and alkaloids. Foliar application of different micronutrients at proper stage helps in improving fruit yield, quality and physiochemical characteristics of pomegranate (Jeyakumar, 2013). It also helps in correcting micronutrients deficiency and improves quality and physiochemical characteristics of pomegranate. The micronutrients like zinc, boron, and ferrous are very important micronutrients required for growth and development of plants. The increase in number of pomegranate fruits by application of micronutrient treatments may be due to increased fruit set and reduced fruit drop as a result of zinc, boron and iron spray could give higher number of fruits and consequently the yield. Pomegranate responds well to foliar application of iron. Ferrous sulphate 0.4 % prior to flowering, at full bloom and at fruit set increases the yield of fruits Combined foliar application of 0.25 % each of sulphates of zinc, ferrous and manganese with 0.15% boric acid increased the yield and juice content.

CONCLUSION

It is evident from all studies on the micronutrients that application of micronutrients on fruit crops improves the nutritional quality of fruit. Although general recommendation are available for most of the nutritional disorder in horticultural crops. Application of micronutrients based on soil and plant nutrient status, at the critical stages of crop growth is absolutely necessary to achieve higher yield and quality.

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