ISSN-0976-5638

Volume 9 | Issue 2 | December, 2018 | 65-69

■ Visit us: *www.researchjournal.co.in*

International Journal of Processing and Post Harvest Technology

A REVIEW

DOI: 10.15740/HAS/IJPPHT/9.2/65-69

Role of micronutrients in better quality and yield of mango

■ Pankaj Kumar[1]* **and** Divyangana[2]

[1]Division of Fruit and Horticultural Technology, PUSA-IARI, **New Delhi, India**

[2]Department of Horticulture, College of Agriculture, G. B. Pant University of Agriculture and Technology, Pantnagar, **Udham Singh Nagar (Uttarakhand) India**

Email : pankajhtmp@gmail.com

*Author for Correspondence

■ **Research chronicle : Received :** 07.11.2018; **Accepted :** 30.11.2018

KEY WORDS : Role of micronutrients, Better quality, Yield of mango

How to cite this paper : Kumar, Pankaj and Divyangana (2018). Role of micronutrients in better quality and yield of mango. *Internat. J. Proc. & Post Harvest Technol.,* **9** (2) : 65-69. **DOI: 10.15740/HAS/IJPPHT/9.2/65-69.**

India is bestowed with a wide range of climatic conditions which is most suitable for cultivation of horticultural crops such as fruits, vegetables, flowers etc. The production of horticultural crops has been increased by 30 per cent in last five years. The continuous raise in the production of horticultural crops placed India 2nd most horticultural crop producing country after China. Horticulture has improved economic status of farmers, seasonal availability of fruits throughout the year increased per capita consumption of fruits. Among fruits mango is the major fruits in terms of area and production and regarded as national fruit of India and it has developed its own importance all over the world.

India occupies first place in mango production of the world and accounts for almost half of the global production and area. India being primary and secondary centre of domestication of *Mangifera indica*, substantial contribution of mango industry in economy, export, livelihood support is well known. Enormous genetic diversity exists in the country. The cultivation of mango in India is as old as 4,000 years as reported by De-Candolle (1883) and on the basis of writing by subsequent botanist it is 6,000 years (Hill, 1952). Mango is also called "King of fruits" because of it is rich source of nutrient, luscious, aromatic flavour, good amount of dietary fibre and carbohydrates and a delicious taste in which sweetness and acidity delightfully blended. It is one of the most important fruits of India and besides delicious taste, excellent flavour and attractive fragrance, it is rich in vitamins A and C. Mango fruit may be utilized at all stages of its development but generally used at mature stages. The production scenario of different fruits in India indicates that all the fruits occupied 6480 thousand ha area with 92846 thousand MT production and 14.3 MT/ha productivity during 2016-17. The total allocation to the fruits in the country has been increased from 6235 to 6480 thousand ha over the previous year, while the total production of fruits has also been increased from 89512 to 92846 thousand MT among total fruit crops the mango occupied 2263 thousand ha area with 19687 thousand MT production and 8.7MT/ha (National mango database 2017)

The productivity and quality of mango is low at national level due to various factors such as indiscriminate use of chemical fertilizers, scanty use of micronutrients, alternate bearing, fruit drop, mango malformation, spongy tissue and susceptibility to major disease and pests (Iyer and Degani, 1997). Among these factors the deficiency of micronutrient play critical roles in enhancing quality and to some extent yield also. An indiscriminate use of chemical fertilizers paved the way for deterioration of soil health and in turn affect trees with yield and fruit quality. Soil is the reservoir of micro nutrients but with the advancement of commercial farming, more emphasis is given to production without taking care of soil health and eventually soil health deteriorates and production falls. The farmers are applying the nutrients mainly through soil application whereas; nutrients can also be applied directly to the site of their metabolism through foliar application. Major elements/ macronutrients are quickly taken up and utilized by the tissues of the plants by catalyzing effect of micronutrients/minor elements (Phillips, 2004). Nutrients are quickly available to the plants by the foliar application than the soil application (Bahadur *et al*., 1998 and Silberbush, 2002). Foliar application of micronutrients may be 6 to 20 times more effective than soil application (Liew, 1988). Soil and foliar application of micro nutrients have a potential to improve productivity and quality and may bring stability and sustainability in the production system in coming few decades, particularly in respect of tropical and sub-tropical fruits. Micronutrients are essentially as important as macronutrients to have better growth, yield and quality in plants. The micronutrients (Boron, iron, copper, zinc, manganese, chloride and molybdenum) are required only in traces, which is partly met from the soil or through chemical fertilizer or through other sources. The major causes for micronutrient deficiencies are intensified agricultural practices, unbalanced fertilizer application including NPK, exhaustion of nutrients and no replenishment. Horticultural crops suffer extensively by Zn deficiency followed by B, Mn, Cu, Fe and Mo. Boron is not only associated with either photosynthesis or enzyme function, but it is also associated with the carbohydrate chemistry and reproductive system of the plant. Thus the micronutrients have significance in growth as well as physiological functions of horticultural crops. Majority of soils across the country are mainly deficient in micronutrients like Zinc, boron, iron and also in macronutrients like nitrogen, phosphorous, potassium. Thus, deficiency of micronutrients is very common resulting in yield and quality loss. Hence, management of micronutrients is critical for increasing the yield and quality. The effects of mineral nutrients including micronutrients on productivity and fruit quality can be greatly enhanced by studying their effects on other phenological events that contribute to productivity and fruit quality. An adequate supply of nutrients including both macro and micronutrients is critical to nutrient management and its sustainability. According to the criteria of essentiality, if a single essential element is below the critical level for availability, crop growth and yield will be affected even if the other elements are in sufficient supply. Balanced nutrition of plants should be a key priority management practices for every grower. Fruit trees grown in well managed orchard, produce more stronger regular bearing and have better disease resistance and are more tolerant to stresses. Moreover, the regular and targeted assessment of mango tree mineral status will facilitate improved management of mango trees. Hence, our aim behind the soil and leaf nutrient study is to observe the current status of macro and micronutrients in crop production and to develop recommendations for farmers and information for extension worker for their adaptability in the field. Micronutrient deficiency in mango can cause reduced vigour, lower production, smaller fruit size, deformed fruit, gummosis and poor fruit quality. Application of micronutrients to the fruit crops by farmers is less because of lack of proper information or their unawareness about the importance of micronutrients or due to non-availability of micronutrients. Unless micronutrients are applied in the required quantity, the productivity and quality of the mango will not increase considerably. Thus micronutrients are the key elements in plants and both are equally important for the growth and development. Foliar feeding of micronutrients are more efficient and economical practice in addition to being more environmentally friendly and sustainable.

General symptoms due to deficiency of micro nutrients:

Boron:

Boron deficiency affects sugar transport and appears to be associated with some of the functions of calcium. Boron affects pollination and the development of viable seeds which in turn affect the normal development of

fruit. A shortage of boron also causes cracking and distorted growth in fruit. Boron does not easily move around the plant and therefore the effects of deficiency appears first and are usually most acute in young tissues, growing points, root tips, young leaves and developing fruit. Ripening is uneven and the developing fruit secrete pinkish white to brown latex. In mango stunted growth with shortened internodes and the small leaves showing pale green colour are the symptoms. The midrib will be brown in colour and the leaves dried and withered under extreme conditions. The symptoms resemble potassium deficiency in some conditions.

Zinc:

Zinc deficiency is the most widespread and limiting growth and yield in fruit crops. It commonly affects banana, custard apple and mangoes. Several mango orchard affected with the deficiency of zinc all over India. 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. In severe deficiency, flushing may stop and twigs or even whole branches die back. Subsequently necrotic patches turn grey and cover the entire surface. Problems often appear in spring when crops are growing quickly but have difficulty in absorbing nutrients from cold soil. The severe stunting of leaves and shoots, which is so typical of zinc deficient crops is a consequence of low auxin levels in tissue. Young leaves are usually the most affected and are small, narrow, chlorotic and often rosetted due to failure of the shoot to elongate. Bloom spikes are small, deformed and drooping.

Iron:

The common deficiency symptoms include development of light green chlorosis of all the tissues between the veins. A distinctive pattern results from the network formed by the midrib and veins, which remain green. If the chlorosis is severe and persistent, yellowing increases to the point of bleaching and burns can develop within this chlorotic area. Because iron does not move easily within the plant, older leaves can remain green while flushes of new growth are chlorotic.

Copper:

Copper deficiency appears to be minimal in tropical fruit crops. The deficiency symptoms include restriction of terminal growth, die back of twigs, death of growing points and occasionally rosetting, and multiple buds form at the end of twigs. Tip necrosis occurs in some young leaves. In mango tip burning of old leaves with grey brown patches is the typical symptom of copper deficiency.

Mangamese:

Manganese deficiency causes a light green mottle between the main veins. A band of darker green is left bordering the main veins while the interveinal chlorotic areas become pale green or dull yellowish colour. In mango the deficiency is exhibited by light green foliage gradually turning yellow with a band of green along the midrib and principal lateral veins. Brown dots will appear all over the leaf surface in later stage.

Molybdenum:

Deficiency is observed in many soils and pasture legumes, vegetables and occasionally cereals, it is very rare in fruit crops. There are few reports that molybdenum deficiency called as yellow spot is observed in citrus (Jeyakumar and Balamohan, 2007). Molybdenum deficiency rare in mango or may be not appear visible.

Role of micronutrients on yield of mango:

The study carried by (Kumar *et al.*, 2017) at Horticulture Research Centre (HRC), Pantnagar and found that the application micronutrients along with major nutrients was found most effective for increasing the number of fruit quality and yield parameters such as fruit-set at marble stage, yield per plant, yield per hectare, increase in yield over control. Jayaprahasam *et al.* (2010) carried out a study on effect of nutrients sprays on fruit set and retention in mango and found that combined spray of calcium and boron was found to be more effective in improving the pollen germination and pollen tubes in pistils in comparison to calcium or boron spray alone, this might be due to the synergetic influence of calcium and boron. An experiment was conducted by Padhiar *et al.* (2011) to study the effect of micronutrient spray on flowering, yield, quality of mango cv. Kesar and found that the lower level of $ZnSO_4$, $FeSO_4$ and borax in combination had influenced flowering and increased length of panicle, this treatment influenced flowering in terms of minimum days

taken to 50 per cent flowering as compared to other treatments and control. Bhatt *et al.* (2008) recommended that foliar spray of 0.5 per cent borax nutrients at 'marbel stage' of mango cv. DASHEHARI results in maximum fruit yield. Gurjar *et al.* (2015) carried out an experiment to overcome the problems such as inherited physiological disorders such as, alternate bearing habit and heavy fruit drop that occurs at different stages in Alphonso mango. The result showed that foliar application of 1per cent $ZnSO_4$, 1 per cent $FeSO_4$ and 0.5 per cent borax in combination had influenced flowering in terms of minimum days (19.67) taken to 50 per cent flowering and increased length of panicle (40.33 cm) compared to other treatments and control, similarly $ZnSO_4$ 1% + FeSO4 1% +borax 0.5% significantly increased the fruit set at pea stage (14.00) and marble stage (7.50), number of fruits per tree (1.73), average fruit weight (314.69 g) and yield per tree (185.09 kg) and decreased the fruit drop (87.66 %) resulted in to overall higher yield.

Effect of micronutrients on quality parameters of mango:

Micronutrients have their impact on quality parameters of produce. The improvement in quality of fruit could be due to the catalytic action of micronutrients particularly at higher concentrations. The foliar application of micronutrients quickly increased the uptake of macronutrients in the tissues and organs of the mango plant and decreased the nutritional deficiencies resulted into enhanced fruit quality. Increased in fruit yield and quality could be due to the effects of nutrients on carbohydrate influx or plant growth regulators synthesized in growing fruits. The physical quality parameters such as fruit weight, fruit length and chemical quality parameters like TSS, total sugar, reducing sugar, non-reducing sugar, total carotenoids content, ascorbic acid pulp) and lower acidity at maturity of fruits were found superior with the application of RDF + NPK : 20:20:20 @ 1 % (2 spray : first-15 days and second 45 days after fruit set) + foliar spray of $ZnSO_4$ @ 0.4 % + Boric acid @ 0.2 % + $CuSO_4$ @ 0.2 % (2 spray at just before flowering and marble stage) (Kumar *et al.*, 2017). Similarly, Bhatt *et al.* (2008) conducted an experiment on mango cv. DASHEHARI. The results indicated that the trees sprayed with 0.5 per cent borax showed maximum fruit weight, fruit volume, T.S.S., reducing sugar, non-reducing sugar and ascorbic acid content and this treatment was found to be at par with 1 per cent Ca (NO_3) 2. Similar response of micronutrients were observed by Singh *et al*. (2015) by conducting an experiment under sodic soil condition to study the effect of foliar spray of nutrients on yield attributing characters of mango and found that the response of foliar application of $ZnSO_4$ (0.4 %) followed by $ZnSO_4$ (0.2 %) were found best for yield attributing characters such as fruit retention, fruit size, fruit weight, pulp weight, pulp: stone ratio as compared to control (Water spray). Anees *et al.* (2011) studied the effect of foliar application of micronutrients (Fe, B and Zn) on the quality of mango (*Mangifera indica* L.) cv. DASHEHARI. The results illustrated that the application of all micronutrients significantly increased the quality of fruit than the control. The trees sprayed with 0.4 % $FeSO_4$ + 0.8 % H_3BO_3 + 0.8% $ZnSO_4$ showed the maximum pulp weight (169.2 g), total soluble solids (27.9 ^{0}Brix), ascorbic acid (150.3 mg/100 ml) and non-reducing sugars (8.83 %) and less stone weight (28.13 g) along with low acidity (0.178 %) in comparison to rest of treatments and control. Hasan *et al.* (2013) conducted a trial on integrated nutrient management to improve fruit quality of Mango cv. HIMSAGAR and the observation on variables such as fruit length, width, weight, pulp weight, pulp content, T.S.S, acidity, reducing sugar, non-reducing sugar, total sugar, vitamin C and β-carotene content were recorded and they found that application of 850 g N + 425 g P_2O_5 + 1000 g K_2O + 250 g *Azospirillium* + 250 g Phosphate solubilizing bacteria + 100 g Zinc sulphate + 100 g borax/tree/year in combination with vermicompost gave higher total soluble solids (21.57 °Brix), total sugar (11.32 %) and vitamin C (25.68 mg/ 100 g) content and lower acid content of fruit.

Conclusion:

Micronutrients are found as constituents in over 1500 proteins where they accomplish catalytic, as co-activator structural functions. From the study of different scientist at different places shows that the role of micronutrients become indispensible in terms of yield and quality of mango. It must be supplied to the plant in right quantity at right time. Even though broad recommendations are available for most of the nutritional disorders in mango but their application should be based on soil and plant nutrient status, at the critical stages of growth is extremely necessary to accomplish higher yield and quality fruits.

LITERATURE CITED

Anees, M., Tahir, F.M., Shahzad, J. and Mahmood, N. (2011). Effect of foliar application of micronutrients on the quality of mango (*Mangifera indica* L.) cv. DASHEHARI fruit. *Mycopath*, **9**(1): 25-28.

Bahadur, L., Malhi, C.S. and Singh, Z. (1998). Effect of foliar and soil applications of zinc sulphate on zinc uptake, tree size, yield and fruit quality of mango. *J. Plant Nutr.*, **21**(3): 589-600.

Bhatt, A., Mishra, N. K., Singh, N. K. and Lal, R.L. (2008). Studies on pre-harvest application of nutrients on yield, quality and shelf life of mango cv. DASHEHARI. *Prog. Hort.*, **40** (1): 41-47.

De-Candolle, A.D.E. (1883). *Origine des plantes cultivees*. Publishing House Germer Bookshop Baillère et Cie ,Paris pp. 159-161.

Gurjar, T.D., Patel, N.L., Panchal, B. and Chaudhari, D. (2015). Effect of foliar spray of micronutrients on flowering and fruiting of Alphonso mango. *The Bioscan*, **10**(3): 1053-1056.

Hasan, M.A., Manna, M., Dutta, P., Bhattacharya, K., Mandal, S. and Banerjee, H. (2013). Integrated nutrient management improving fruit quality of mango cv. HIMSAGAR. *Acta Hort.*, **992**: 167-172.

Hill, A.F. (1952). *Economic botany* (Ed. 2) Mc Graw-Hill and Kogakusha.

Iyer, C.P.A. and Degani, C. (1997). *Classical breeding and genetics*. In: Litz RE, editor. *The mango: Botany, production and uses*. Wallingford Oxon/CAB International, pp. 49- 68.

Jayaprahasam, S., Singh, R. and Singh, S.K. (2010). Effect of nutrients sprays on fruit set and retention in mango post hybridization. *Indian J. Hort.*, **67**: 429-431.

Jeyakumar P. and Balamohan T. N. (2007). Training manual on role of balanced fertilization for horticultural crops In: Kumar N (ed) *Micronutrients for Horticultural crops*, Tamil Nadu Agricultural Uiversity, Coimbatore (T.N.) India.

Kumar P., Singh A.K. and Shankhdhar, S. C. (2017). Efficacy of soil and foliar application of macro and micronutrients on yield and quality of mango cv. 'DASHEHARI. *Internat. J. Curr. Microbiol. App. Sci.*, **6** (10): 1855-1861.

Liew, C.S. (1988). Foliar fertilizers from Uniroyal and their potential in Pakistan. Proceedings of Seminar on Micronutrient in Soils and Crops in Pak. 277pp.

Padhiar, B.V., Nehete, D.S., Shah, N.I., Bhalerao, P.P., Kolambe, P.P. and Bhalerao, R.R. (2011). Influence of micronutrient spray on flowering, yield, quality and nutrient content in leaf of mango cv. KESAR. *Asian J. Hort.*, **6**(1): 63-67.

Phillips, M. (2004). Economic benefits from using micronutrients for the farmer and the fertilizer producer. International symposium on micronutrients. New Delhi, India. pp. 23-25.

Silberbush, L.F. (2002). Response of maize to foliar vs. soil application of nitrogen, phosphorus and potassium fertilizers. *J. Plant Nutr.*, **25**: 233-234.

Singh, A., Yadav, A.L., Singh, J.P. and Vishwakarma, G. (2015). Effect of foliar spray of nutrients on yield attributing characters of mango (*Mangifera indica* L.). *Res. Environ. Life Sci.*, **8** (3) : 469-470.