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Technical Report

Micronutrient management for mango and guava orchards: farmers' perspective

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Indian soils are generally deficient in micronutrients. However, the degree of deficiency is higher in case of Zinc (Zn) and Boron (B). The average level of Zn deficiency in Indian soils is estimated to be around 50% and is projected to increase to 63% by 2025 (Singh 2001). The micronutrient deficiency is significantly related to the food and nutritional security of human being. It was estimated that around 26% of India's population is at risk of zinc deficiency. The problem of micronutrient deficiency in ubiquitous, with deficiency of micronutrients had leads to health risk across the globe (Alloway 2007, Black *et al.* 2008). The problem of micronutrient deficiency is not the only man-made problem but also a number of soil related issues are associated with it.

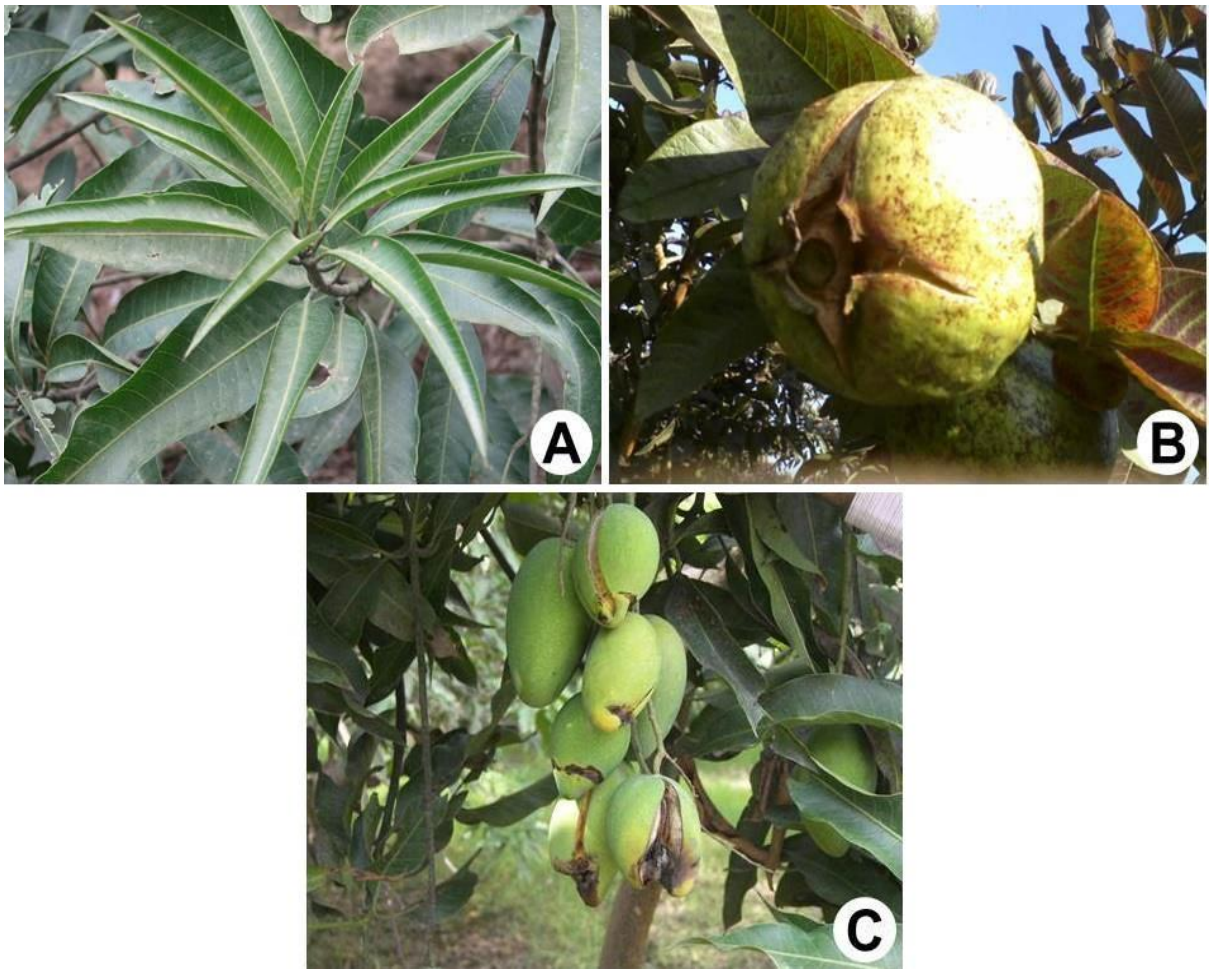

Figure 1. Symptoms of micronutrient deficiency: **A,** Zink deficiency in mango; **B,** Boron deficiency in guava (cracking of fruit); **C,** Boron deficiency in mango cracked mango (cracking of fruit).

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Table 1. Soil reaction and micronutrient distribution in 20 mango orchards of Malihabad region, Lucknow, Uttar Pradesh.

Sampling Sites	pH	Zn (mg.kg^{-1})	Cu (mg.kg^{-1})	Mn (mg.kg^{-1})	Fe (mg.kg^{-1})
1	6.16–7.51	0.38–1.64	1.04–3.12	5.26–14.22	6.48–17.68
2	7.19–7.86	0.58–1.14	1.26–2.74	4.96–12.34	6.52–10.48
3	6.97–8.40	0.36–1.54	0.78–2.78	1.28–12.88	2.68–17.22
4	6.51–7.34	0.36–0.98	2.46–3.34	7.56–13.92	11.14–18.12
5	6.02–6.87	0.28–0.84	1.54–3.02	6.78–13.62	7.64–18.48
6	6.68–7.99	0.34–2.28	1.24–3.34	2.82–12.86	6.56–17.26
7	6.66–7.25	0.32–0.68	1.68–3.26	5.56–14.48	6.44–15.94
8	7.24–8.41	0.32–1.26	0.84–2.36	1.62–9.74	2.76–12.22
9	7.39–8.04	0.32–1.18	0.92–2.16	3.48–8.78	4.36–11.52
10	7.67–8.12	0.32–0.82	1.16–2.48	2.76–8.98	4.54–11.04
11	7.15–7.66	0.46–2.52	0.78–2.96	3.66–10.22	7.80–18.92
12	7.22–7.77	0.64–2.86	2.36–3.42	3.14–7.82	11.72–19.46
13	7.10–7.71	0.36–1.74	0.98–3.36	2.72–7.36	7.32–16.28
14	7.01–8.10	0.42–1.36	1.68–3.62	3.68–10.96	6.08–10.26
15	6.76–7.76	0.54–1.96	1.86–3.42	3.54–7.22	3.24–14.32
16	7.00–8.27	0.38–2.24	1.96–3.32	2.58–4.92	7.34–13.64
17	6.98–7.54	0.36–1.22	2.28–3.40	1.12–8.42	2.86–14.26
18	6.81–8.39	0.42–2.06	1.28–2.90	0.92–5.26	2.62–14.02
19	7.19–8.66	0.44–2.54	1.56–3.36	1.22–6.18	2.76–12.88
20	6.91–8.12	0.34–2.08	1.38–2.76	1.36–6.26	1.98–9.12

The problem of micronutrient management and deficiencies if present at all, needs to be addressed seriously, particularly in the case of fruit crops. Orchard farming needs special attention in micronutrient management as fruit quality and productivity is directly related to it. Sometimes plant shows hidden hunger symptoms also and may not show any deficiency symptoms in leaf tissues even if soils showed deficient in a particular nutrient. It has been estimated that widespread micronutrients deficiencies existed in mango orchards of Uttar Pradesh. The orchards of Moradabad, Rampur, Bareilly, Shahjahanpur, Hardoi, Lakhimpurkhiri and Sitapur districts of Uttar Pradesh showed wide variations in micronutrient contents and deficiencies across management practices adopted by mango growers. The percentage deficiency of Zn ranged between 5.9 to 75.0 percent in soil and 33.3 to 100 percent in leaf tissue analysis (Kumar *et al*. 2015). Spatial distribution indicated that orchards of Shahjahanpur districts are deficient in Zn (75 per cent) followed by orchards of Hardoi (50 per cent) and Bareilly (36.6 per cent) districts respectively. Cent per cent orchards of Bareilly, Shahjahanpur and Hardoi were deficient in both Cu and Mn while the soils of the orchards of Rampur and Lakhimpurkhiri districts were deficient in Mn (Kumar *et al*. 2015). Available Fe was in optimum range in most of the orchards in all the districts however, only few orchards of Rampur and Bareilly showed Fe deficiency. In another study, 250 soil samples were collected from 20 villages of mango orchards of Malihabad, famous for its Dashehari mango production in Uttar Pradesh and widespread variations in micronutrient content were revealed (Table 1). Mango orchards deficient in Zn and Mn content were also recorded. Factors like coarse texture of soils, low organic matter content, microbial activity and non-application of micronutrients in the orchards under subtropical environment may be responsible for this. Zn deficiency symptoms were widely seen in mango orchards in India and particularly in Uttar Pradesh (Fig. 1A) and to correct the deficiency, spraying of 0.5% $ZnSO_4$ is advocated.

Figure 2. Mango fruit loss by black tip due to SO_2 emission from brick kline.

Boron is another crucial micronutrient limiting crop production (Shukla *et al*. 2014). Boron plays an important role in reproductive as well increasing quality fruit production. Mango crop varies in their requirements. This variation may be due to source of irrigation water, climate and season, rootstock, age and developmental stages of plants. Of course, B is present in soils in the form of mineral tourmaline which is extremely resistant to wreathing, thus relatively immobile in plants resulting in deficiency symptoms. The symptoms are showing first in the growing part (young levels) and cracking of fruits finally (Fig. 1B, C). To correct B deficiency, application of 100g borax per plant is recommended during the month of September-October. Foliar application of boron, useful for optimum improvement in fruit quality of mango with spray of 0.5% boric acid solution at peanut and marble size of fruits. Sometimes, B was also observed in high pH soils causing toxicity of B. It has been noted that Zn concentration in the lower level, enhances boron accumulation.

Mango orchards situated near the brick Kline many times affected by black tip due to SO_2 emission. It forms an acid that burns the tissue of mango fruit and deteriorate the quality. The intensity of the affected fruit quality depends on the height of the brick Kline and wind direction. Farmers often came across yield and profit loss (Fig. 2). To counter this man-made problem, setting up of brick Kline should not be permitted nearby clusters of mango orchards.

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