Management Of Micro Nutrient Deficiencies In Oilpalm

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Introduction:

Oil palm needs a huge amount of nutrients as it produces one of the highest dry matters among the C3 plants. The nutrient requirement of oil palm varies widely, and depends on the soil type, ground cover conditions, target yield, type of planting material, palm spacing, palm age, as well as climate and other environmental factors. It is also associated with the amount of nutrients removed in harvested fruit bunches, nutrients recycled to the soil through pruned fronds, male inflorescences and leaf wash and nutrients immobilized in the palm biomass. Oil palm removes a higher amount of nutrients compared to other plantation crop.

Nutritional imbalance is one of the major limitations to oil palm productivity in oil palm growing countries including India. It is possible to overcome nutrient imbalances by proper nutrient management. Otherwise, nutrient imbalances like deficiency / disorder could be rectified after proper identification followed by application of that particular nutrient(s) either by soil or foliar application. The nutrient deficiencies and disorders in oil palm, their symptoms and corrective measures recommended for Indian plantations are described below. The most frequent micronutrient deficiency symptoms in plantations are those attributed to Mg, B, Fe, Mn and Cu.

Magnesium (Mg) deficiency:

Heavy application of potash fertilizers causes Mg deficiency. Mg deficiency also appears when palms are grown on soils of granite origin, peat soils and acid – sulphate soils. The symptoms of Mg deficiency are likely to become visible on older leaves when the Mg content falls to about 0.15 - 0.2% of dry matter. Symptoms are also observed when the ratio of K: Mg and N: Mg exceeds about 5 and 10 respectively. Olive green and ochre coloured (Figure 4) areas appear on the pinnae of older leaves and merge gradually with the healthy green tissue. The yellow colour spreads down towards the frond midrib until the whole pinnae are affected, becoming a deep orange colour in later stages. 'Shading effect' is the most apt diagnostic features of Mg deficiency, in which there is an absence of chlorosis in parts of affected pinnae, protected from direct sunlight. As the deficiency becomes more intense, the purplish brown lesions expand rapidly until the entire pinna is affected with distal and marginal tissues being most affected. Application of 500 g magnesium sulphate /adult palm / year or spraying of 2% solution of epsom salts at 3 – 4 intervals for a period of 2 – 3 weeks is recommended to overcome Mg deficiency.

Fig 1. Orange frond or yellowing showing magnesium deficiency in oil palm

Magnesium (Mg) deficiency is usually more spectacular than harmful. The yellowish-orange zones most often located at the tips of fronds and leaflets usually appear on the edge of a plot. Symptoms are worsened by exposure to sunlight: this particularity is therefore an excellent deficiency indicator, as portions of leaflets that are less exposed are greener than the rest of the lamina (Fig.1a). Symptoms first occur on the lower fronds

before a significant effect on yields is seen. Deficient palms often occur in patches that coincide with sandy or stony soils with low mineral reserves. For all these reasons, a corrective fertilizer application can only be exceptional and on small areas if the diagnosis is based solely on observing symptoms.B Pic - The leaflets of the upper layer have been removed between the two points indicated by the arrows, revealing the leaflets of the lower layer that are much greener. This difference in tissue colour between low or high exposure to light is typical of magnesium deficiency.

Boron (B) deficiency:

Boron deficiency in oil palm occurs due to high rainfall conditions, sandy and peat soils, low and high pH soils, and heavy applications of nitrogen and potash fertilizers. On the basis of leaf analysis data, when the level of boron falls below 10 ppm of dry matter, symptoms of incipient deficiency are observed. B deficiency is difficult to detect. Experienced agronomists attribute several symptoms to this deficiency, which disrupts the terminal buds of the palms with, in increasing order of intensity: crinkling of distal leaflets, leaflet malformations (Hook Leaf) (Fig.2) stunting of leaf rachises, resulting in a stump in serious cases. These are associated with the more frequent appearance of pale yellow stripes parallel to the leaflet midribs. All these symptoms sometimes indicate a true nutritional problem, especially at the susceptible age between 2 and 5 years. The most decisive criterion is the appearance of new fronds that are shorter than the previous ones, giving a flat top growth habit to young palms. However, malformations of distal leaflets, or the existence of yellow stripes, are not alone a reliable criterion for deciding on the need to fertilize, especially in mature palms. Leaflet malformations may have a physical origin at the time the frond opened. Indeed, such malformations often occur on only one side of the frond (always the same), which suggests they are linked to the phyllotaxis of the oil palm. There may be other reasons for such malformations, notably insect damage.

Fig. 1A & B: Two views (1A and 1B) of the same frond affected by a severe magnesium (Mg) deficiency

The different malformations (Fig.2a) such as hook leaf, fish bone leaf, rounded frond tip, blind leaf, leaflet shatter and bristle tip are attributed to B deficiency. In hook leaf, a terminal hook develops on one or more pinnae, usually towards the tip of the frond. The hook may have a corrugated appearance and tissue distortion affecting both the midrib and lamina. Because of hook fragility, hook leaf symptoms are most frequently seen on younger fronds. The increasing severity of hook leaf symptoms is marked by folding and general distortion of tissues. The 'Fish bone leaf' is considered to be a part of hook leaf - little leaf complex. One or more fronds may be slightly smaller than normal but the pinnae are abnormally stiff, narrow and widely spaced along the rachis, sometimes bearing terminal hooks. An early symptom of possible B deficiency is the rounding of the tip outline of the youngest frond. This results from the shortening of the pinnae towards frond tip. In blind leaf, a pair of pinnae does not terminate the apex of the oil palm frond. Occasionally, one or more laterally situated pinnae at the tip develop in such a plane that the terminal gap is less large. In leaflet shatter, pinnae drop sharply at one particular point. The midrib is normally fractured transversely and the adjoining laminar tissues are rapidly shredded through wind action. This appears as one of the shattered lamina tissues and remnants of midrib protruding from the rachis. Bristle tip is regarded as a transitional symptom between hook leaf and little leaf. There is a replacement of a group of pinnae at the frond apex by a tuft of long, fibrous bristles of varying rigidity. Corrective application of 20g of boron/ adult palm/year in the palm basin.

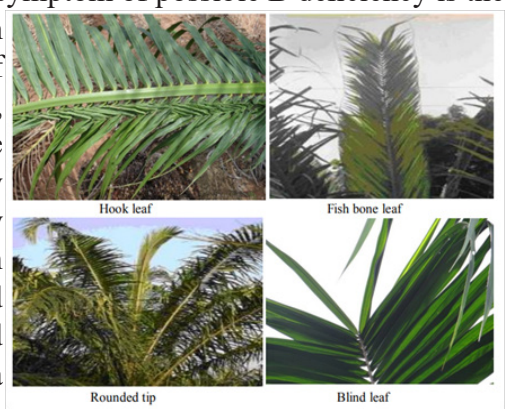

Fig. 2a. Boron deficiency symptoms in oil palm

Copper (Cu) deficiency: Copper (Cu) deficiency has been reported on sandy soils and peat soils. Up to three years old it can lead to some plant losses if no copper is applied. Beyond that age, the risk of copper deficiency disappears. Heavy application N and P fertilizers also induce copper deficiency. The first copper deficiency symptoms involve plasmolysis of young frond rachises: the palm takes on a typical arched and sagging shape (Fig. 3). Leaflet tips are then affected by a typical graduated brown-yellow-green discoloration. With a severe deficiency, new fronds are increasingly stunted and the deficiency sometimes kills the palm. Deficiency symptom appears initially as whitish yellow mottling of younger fronds. As the deficiency intensifies, yellow, mottled, interveinal stripes appear and rusty, brown spots develop on the distal end of leaflets. Affected fronds and leaflets are stunted and leaflets dry up. Copper deficient plants exhibit severe stunting in the nursery (Figure 3a). Basal application of 50g Copper sulphate to affected palms or application of potash fertilizer eliminates the deficiency.

Fig 3. Copper deficiency in nursery

Fig. 3a: Copper eficiency on peat soil arched and sagging shape of the palm

Iron deficiency

Iron deficiency occurs in soils of very high pH, on or near termite mounds, overlying coral and on poorly drained soils. Heavy application of phosphatic fertilizers results in Fe deficiency. Interveinalchlorosis appears on the youngest fronds but leaf veins remain green (Fig.4). The youngest fronds later turn white but older fronds are yellow. Growth ceases and death may occur after one year in severely Fe deficient palms. It is recommended to provide two to three foliar applications of ferrous sulphate (0.5%) at a weekly interval to rectify the problem.

Manganese (Mn) deficiency: Manganese (Mn) deficiency is rare. It occurs exceptionally in situations where calcium blocks manganese uptake if it is overabundant in the soil. Deficiency is then reflected in the deterioration of chlorophyll tissue and frond stunting; these symptoms are easy to identify (Fig. 5). Palms displaying such symptoms require manganese sulphate fertilizer to resume normal growth and yields. Manganese deficiency appears in highly leached tropical soils, deep peat soils, or where large amounts of limestone have been applied to sandy soils. Soil with high exchangeable Mg status also induces magnesium deficiency. During deficiency, discontinuous interveinalchlorotic streaks first appear on younger fronds. These longitudinal streaks eventually become chlorotic with a striped appearance. Newly emerged fronds become progressively smaller and chlorotic, and the palm canopy appears retarded. In severe cases, chlorosis and necrosis affect the newly emerged spear before frond pinnae have expanded. In contrast to Mg deficiency, the symptoms are found on young rather than on older fronds. The symptoms are equally pronounced on upper (sun exposed) and lower (shaded) rank pinnae. Foliar spray of 50 g Mn L-1 is sufficient to overcome Mn deficiency.

Conclusion:

Some nutrients can be deficient and limit yields though their deficiency is even invisible to the naked eye, as for chlorine (Cl). Yet, some Cl deficiencies can severely reduce yields.

Location specific micro nutrient trials conducted so far have revealed that the quantity of fertilizers to be applied varies from place to place and accordingly fertilizer dosage has been recommended. Micronutrients application in oil palm should be strictly based on the visual symptoms. Nutrient contents of oil palm biomass are considerable and could be effectively recycled to meet its nutritional requirements.