Agnote

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Mango Leaf and Soil Analysis

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Chemical analysis of mango leaf and soil samples is a useful tool for establishing the current nutrient levels in an orchard. However it does have its limitations, as discussed in Agnote D39 “Mango Leaf and Soil Sampling”. Care should be exercised when interpreting the results from the first year’s analysis. Do not make major changes to the fertiliser program in the first year, unless the analysis of a particular element is in the extreme deficient or excess range. It is better to wait for the results from the second and subsequent years to see if the levels are consistently high or low before taking action.

1. SOIL ANALYSIS

Virgin soils in the Top End are usually acid, deficient in all elements, have very low to nonexistent organic matter content and are generally free draining with poor water and nutrient holding capacities. The following determinations are normally required for mango soil sampling. Maintaining good levels of elements in the soil as well as a balance between them is important if the plant is to obtain sufficient nutrients to produce a good crop. For example, high phosphorus (P) levels in the soil can suppress zinc (Zn) availability to the plant (even though there may be adequate amounts of Zn present), causing a deficiency.

Boron toxicity symptoms on mango leaves caused by excess application of boron. This can be avoided by using regular soil analysis.

Electrical Conductivity (EC)

This measures the total soluble salt level in the soil. The addition of fertilisers and gypsum will raise the salt levels in the soil. With our high rainfall and sandy soils in the Top End it is usually not a problem as the salts get leached out. Salt levels above 0.1 mS/cm indicate a build up of salt in the soil and above this level could inhibit root development and optimum plant production.

Soil Acidity (pH)

A pH of 7 is considered neutral. If the pH level is higher, i.e. 8, the soil is considered alkaline. Conversely, if the pH level is lower, i.e. 6, the soil is acid. Mangoes will tolerate a wide range of pH levels, but at the extreme ranges of pH certain elements become unavailable to the plant even though there may be adequate or even high levels of these elements in the soil. The ideal level is pH 6.5 where all elements are available to the plant. Most soils in the Top End are acid, the addition of fertiliser also tends to acidify the soil. To raise the pH, lime is added to the soil. If magnesium (Mg) levels are low then dolomite is used as it contains magnesium. If the pH is correct but calcium (Ca) levels are low, gypsum should be used.

Available P
P is almost undetectable in virgin soils in the Top End. It is an important element especially for young plants as it helps root development. Other factors it is involved with are fruit development and yields.

Available Potassium (K)
K levels are usually very low in virgin soils. This element is important in the production of good quality fruit as well as increasing disease resistance.

Ca
Ca is an important part of all plants. It is used in cell walls, and plays a major role in root and shoot development as well as improving fruit quality and colour.

Mg
Mg is a constituent of chlorophyll playing a vital role in photosynthesis. In mangoes high levels can result in dark green fruit.

Sulphur (S)
One of the many roles of S is in the utilisation of nitrogen (N) in plants. Pale green or yellow leaves are one of the deficiency symptoms of this element.

Zn
Zn is usually deficient in all Top End soils. It is involved in growth of the plant and typical symptoms are stunted growth and small cupped leaves with yellow between veins.

Boron (B)
B is closely linked to Ca movement around the plant. It is also involved with flower and pollen development. Deficiencies can cause poor fruit retention. High levels can be toxic to the plant.

Table 1. Optimum soil levels for mangoes

Nutrient	Normal (mg/kg)	Normal ($cmolkg^{-1}$ or meq/L)
EC mS/cm^2	Below 0.1	
pH	6.5 – 7.0	
P	70 mg/kg	
K	100-150 mg/kg	0.25 – 0.38 $cmolkg^{-1}$
Ca	600-1000 mg/kg	3.0 – 5.0 $cmolkg^{-1}$
Mg	90-150 mg/kg	0.75 – 1.25 $cmolkg^{-1}$
S	10-20 mg/kg	
Zn	2-10 mg/kg	
B	1-2 mg/kg	

2. FACTORS AFFECTING LEAF ANALYSIS RESULTS

Physical State of the Tree
If the tree is in a state of stress, such as disease/insect attack (e.g. termites), or severe droughting, nutrient levels are likely to be low. There is little point in doing a leaf analysis from a sick tree. When the tree is pushing out a new flush of growth nutrients are moving into the new shoots and often out of the old leaves. The best time to take samples is when the flush has hardened off and matured, with the tree in a dormant state (e.g. before flowering).

Waterlogging

Waterlogging also induces stress and reduces the uptake of most nutrients, so even though soil nutrient levels are adequate, they may not be taken up by the plant and leaf levels will indicate deficiencies.

Weeds

Weeds compete for nutrients, especially N. Often the effective use of herbicides, where weeds have built up, increases N levels in the plant without fertiliser being applied.

Fungicides/Foliar Fertilisers

Recent foliar applications of trace elements, fertilisers or fungicides will raise the levels of these elements in leaves even after they have been washed.

Nutrient Imbalances

Maintaining a correct balance between elements is important, as high levels of one element can affect the uptake and levels of another, e.g. high N levels can cause low Ca levels.

Variety/Rootstock

Most fruit trees show different standard levels between varieties. Rootstocks can also have an effect. To date very little research has been done in Australia on the effect of various rootstocks on mangoes. The leaf standards shown here are for Kensington Pride (KP) mangoes and may differ for other varieties.

3. INTERPRETATION OF LEAF ANALYSIS

The standard values in Table 2 are for KP mangoes and have been adjusted to suit Top End conditions. By comparing the chemical analysis with the standard values in Table 2 the orchard nutritional status can be determined. Definitions of the terms deficient, low, normal, high, and excess are given below.

Deficient: Deficiency symptoms are visible; level is too low for optimum performance.

Low: Usually no visible symptoms; level is below normal and may be insufficient for optimum performance.

Normal: No visual symptoms; level is normal and should be adequate for optimum performance.

High: No visual symptoms; level is above normal and could be causing a nutritional imbalance.

Excess: Toxicity symptoms may be present; level is too high for optimum performance.

Work is still being conducted on mango nutritional requirements. To date there appears to be little correlation between leaf nutrient levels and yields. Many of the other factors which go towards a good crop are out of our control, such as the weather. However if the leaf elements can be maintained at the recommended levels it is the first step towards achieving a good yield.

Table 2. Standard leaf levels for KP mangoes in the Top End

Nutrient	Deficient	Low	Normal	High	Excess
N %	<0.65		0.8-1.2		
P %	<0.05		0.08-0.18		>0.8
K %	<0.25	0.25-0.3	0.4-1.2		
Ca %			1.5-2.8		
Mg %			0.2-0.4		
S %			0.1-0.23		
Copper mg/kg			10-20		
Zn mg/kg	<15		25-60		
Manganese mg/kg			100-500		
Iron mg/kg			30-120		
B mg/kg			50-100		>300

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