Leaf and soil analysis

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Leaf and soil analyses are important monitoring tools to assist annual nutrient management in mango orchards. These analysis results together with the properties of the block (e.g. soil type, variety and management history) and prevailing conditions (e.g. flood, drought and crop load) are taken into account to develop a fertiliser program for the year.

Leaf analysis is recommended annually and soil analysis typically every second or third year. It is important to note that while soil analysis results can identify actual soil nutrient levels, these may not necessarily be fully available to the plant. It is best to take the soil sample at the same time as the leaf sample, this way one can be used to help explain the other and there is more confidence in the interpretation.

Using regular leaf and soil analyses allows a customised fertiliser program to be developed to optimise productivity and fruit quality. In this way fertiliser application efficiency if maximised, with the additional benefit of minimising off-site nutrient losses into the environment, particularly into waterways and the oceans.

Leaf and soil analysis kits, with sampling instructions, are usually available from your local fertiliser agent or from the laboratory itself. We recommend that you only use an Australasian Soil and Plant Analysis Council (ASPAC) or National Association of Testing Authorities (NATA) accredited laboratory.

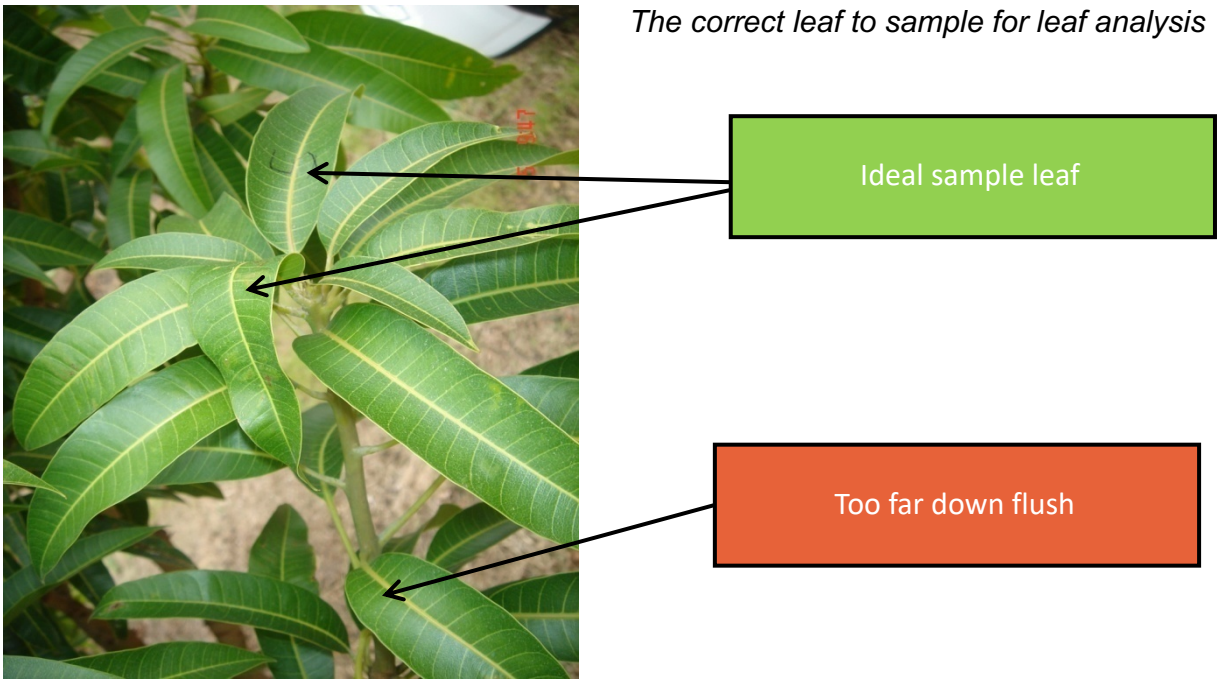
Leaf tissue analysis

Timing

Nutrient levels in the leaf vary greatly during the season in response to key growth periods. For this reason, leaf tissue samples must be taken at the time of the year when the levels are the most stable. In mango, this occurs at two key times in the phonological cycle. The first is in summer, in the short period immediately after harvest and before the first major vegetative flush. The second is in winter, at the end of the autumn dormant period and before flower initiation. The winter period is the time when leaf nutrient levels are the most stable.

Sampling

Select the youngest fully expanded and hardened leaf; these leaves will be about eight weeks old. Collect four or five leaves per tree from 10 representative trees across the block to make a sample of 40-50 leaves. A sample should not contain leaves from mixed varieties, different ages, different soil types or across blocks that are managed in different ways. Also, avoid sampling the outside rows of blocks, or trees at the ends of rows. Mark the sample trees or record their position for future tests. Send the sample/s away for analysis to an ASPAC or NATA accredited laboratory.



The correct leaf to sample for leaf analysis

Optimum leaf nutrient ranges for mango

Element	Optimum Leaf Level
Nitrogen (N)	**1.0 – 1.5 %**
Potassium (P)	**0.75 – 1.20 %**
Phosphorus (K)	0.1 – 0.2 %
Calcium (Ca)	**2.0 – 3.5 %**
Chloride (Cl)	< 0.25 %
Magnesium (Mg)	0.15 – 0.40 %
Sodium (Na)	< 0.20 %
Sulphur (S)	0.1 – 0.2 %
Boron (B)	**50 – 70 mg/kg**
Copper (Cu)	10 – 20 mg/kg
Iron (Fe)	30 – 120 mg/kg
Zinc (Zn)	20 – 100 mg/kg
Manganese (Mn)	60 – 500 mg/kg
Molybdenum (Mo)	0.05 – 0.10 mg/kg

(Note: Some analysis reports express elements in ppm, this is the same as mg/kg.)

Soil analysis

Why soil analysis is used

Soil analysis is used to monitor soil properties including pH, conductivity, organic matter levels, cation exchange capacity (CEC) and also nutrient levels in the soil. It provides important information on:

- The less soluble nutrients such as calcium, magnesium, phosphorus and zinc.
- The ratio of the cations (calcium, magnesium, potassium and sodium) in the soil which need to be in balance.
- The ratio and levels of iron and manganese in the soil (soil iron level is more reliable than the leaf level, and it is important to know whether manganese is at toxic levels).
- Boron levels in the soil, this is a critical trace element for mango but can be hard to manage.

Soil analysis is not generally required as often as leaf analysis but should be conducted every two to three years. This is particularly the case for pH management, measuring cation balance and to monitor the longer term impacts of the annual fertiliser programs.

Where to sample

Take soil samples to a depth of 0-15cm, from under the tree canopy, within the wetted area of the sprinklers, and at least 30 cm from the tree trunk. Take sufficient subsamples across the block to ensure the sample is representative of the block. Avoid sampling the outside rows of blocks, or from under trees at the ends of rows. Mark the sampling spots or record their position for future reference. Send the sample/s away for analysis to an ASPAC or NATA accredited laboratory.

Understanding soil test results

Unlike leaf tissue tests, for which the same laboratory extraction techniques are generally used by all laboratories, results from testing the same soil sample at different laboratories will often produce different results. This is because different laboratories often use different extraction techniques. Generally the laboratory will select an extraction technique that they believe will give the best indication of plant-available nutrient from the soil types they generally deal with. Therefore when studying soil test results it is important that you compare them with the optimum range suggested by the laboratory that did the analysis.

Note that a poor relationship has been shown between soil and leaf analyses for phosphorus, zinc, boron and iron.

Optimum soil nutrient ranges for mango

Element	Optimum Soil Level
pH	5.5 – 7.0
Organic Carbon	1 – 3 %
Conductivity	<2.0 dSm
Nitrogen – Nitrate (NO3)	**<15 mg/kg**
Phosphorus (Colwell test)	60 – 80 mg/kg
Potassium	**100 – 150 mg/kg or 0.25 – 0.4 meq/100g**
Sulphur	> 12 mg/kg
Sodium	<1.0 meq/100g
Chlorine	<250 mg/kg
Calcium	**600 – 1000 mg/kg or 3 – 5 meq/100g**
Magnesium	96 – 150 mg/kg or 0.75 – 1.25 meq/100g
Copper	0.3 – 10 mg/kg
Zinc	2 – 15 mg/kg
Manganese	4 – 50 mg/kg
Iron	4 - 100 mg/kg
Boron	**1 - 2 mg/kg**
Cation Exchange	~5 meq/100g
% Sodium saturation	< 1 %
% Potassium saturation	5 – 7 %
% Calcium saturation	65 – 80 %
% Magnesium saturation	15 - 20 %

(Note: Some analysis reports express elements in ppm, this is the same as mg/kg.)