SAMPLING PLANT TISSUE FOR NUTRIENT ANALYSIS

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Many growers use soil tests and visual inspections to determine fertiliser inputs to their orchard. While these methods are useful and have their place, plant tissue mineral analysis is the key to understanding the nutrient status of the orchard. Scott Hill from Healthy Hills Horticulture takes a close look at plant tissue mineral analysis and the keys to sampling leaves.

The key tools for assessing any horticultural tree crop are:

- visual inspection
- soil chemical analysis
- plant tissue mineral analysis
- crop removal values.

While a visual inspection of a macadamia orchard can help identify mineral deficiencies and toxicities, symptoms are only seen when the deficiency or toxicity is severe. Soil chemical analysis is a very useful tool for identifying soil chemical properties such as soil pH, CEC, soil mineral levels and toxicities (salinity, high sodium, aluminium etc.). Crop removal values can be used to quantify nutrients exported from the orchard, so we can replace them as necessary.

Plant tissue mineral analysis is the best indicator of plant nutrient status and the best way to determine fertiliser inputs.

Sampling the key

When obtaining plant tissue for analysis it is very important to collect the correct part of the plant at the correct time to allow comparative analysis with the industry set of nutrient standards. The collection procedure used by the Australian macadamia industry is based on criteria developed in Hawaii, which was adapted for local conditions in the 1980s and then in 2007.

An imprecise leaf sample will give incorrect results that lead to ineffective interpretations and recommendations on nutrient management, something that could prove costly to the grower.
The important factors when sampling leaves are leaf age, when sampling is done, location of leaves on the tree and avoiding areas of the tree that are shaded.

Leaf age. Leaf age is important to ensure an accurate reflection of plant nutrient uptake that corresponds with standards. Nutrients can be either mobile in the phloem or immobile, and their concentrations will differ depending on leaf age. Phloem mobile nutrients such as N, P and K will translocate to other plant parts on demand; phloem immobile nutrients such as Ca and Mn will not translocate and will therefore accumulate in leaves over time.

Time of sampling. The recommendation is to take leaf samples in spring. The most important reason to collect leaf samples in spring is to coincide with the Australian macadamia leaf nutrient standards. These standards were developed based on autumn flush leaves from the second whorl sampled in spring. Because of high nitrogen and potassium demand in summer for nut growth, husk development, oil accumulation and the summer flush, spring provides an ideal time to monitor crop nutrient status.

A major difficulty in collecting samples in spring is that this is when a flush often occurs. Flushing terminals need to be avoided because mobile nutrients are being translocated to the new shoot. It is recommended to not sample leaves from a terminal with a shoot longer than 6 mm.

Avoiding areas that are shaded. It is important to sample leaves from parts of the tree that are well exposed to sunlight. This is because research has found that leaf N and leaf P are affected by shading in mature, high density orchards.

Getting this right can sometimes prove difficult. For example, if the trees are flushing those terminals need to be avoided. Of the remaining terminals insects such as thrips, mites and caterpillars can cause damage that makes it difficult to find an appropriate sample. At times leaves of the second whorl may be affected but leaves of the first, third or fourth whorls are not.

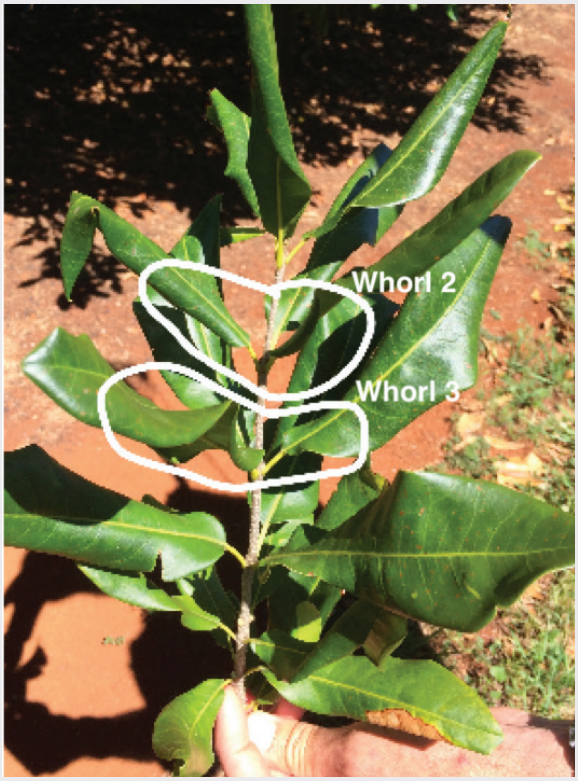
Available literature does not justify the requirement of collecting leaves from the second whorl, so in 2016, Dr Robyn Cave and I conducted a study at the University of Queensland to determine if there is a difference between leaf whorls and nutrient levels. This study showed that

Sampling leaves for analysis

Collect:

- leaves from the second or third whorl
- leaves that are not shaded
- hardened leaves - ensure bark of shoot is similar to older bark
- leaves from the non-flushing terminal (new shoot must not be longer than 6 mm)

Sample leaves in spring and rinse sampled material thoroughly in deionised water to remove contaminants, which could contain nutrients, e.g. dust, foliar fertilisers and fungicides.



Sample leaves from the second or third whorl, as indicated in the photo.

there were differences for some nutrients between whorls two, four and five, however, not between whorls two and three. This means that leaves from the third whorl could be collected when those from the second are not suitable.

The bottom line

Plant tissue analysis is a useful tool for helping with nutrition management of macadamias. A requirement for obtaining quality information on plant nutrient status and nutrient management is following set criteria when sampling leaves. The sampling criteria we have today for macadamias, the result of research over the last 60 years, provide the best quality plant nutrient status information.

Note. The Australian sampling criteria and nutrient standards were developed based on the significant research effort over two decades of Russ Stephenson, Ian Vimpany and David Huett.

More Information

For more information on this topic visit the Australian macadamia industry website www.australianmacadamias.org/industry or contact the Industry Development Manager at the AMS on 1800 262 426.

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About Healthy Hills Horticulture

Healthy Hills Horticulture is based in Northern Rivers, NSW. We specialise in plant nutrition and pest management advice for macadamia and blueberry production. We are committed to delivering the highest quality information based on sound research and quality data. Healthy Hills services macadamia farms from Macksville, NSW to Rockhampton, Queensland.