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ask the AWRI

Fertilisers & Vine Nutrition

Tissue analysis - more than just numbers

In this article, AWRI Viticulturist **Spiro Papadopoulos** answers grower questions about grapevine tissue analysis results.

The Australian Wine Research Institute (AWRI) regularly receives enquiries from growers trying to make sense of grapevine tissue analysis results. Some are deciding whether to test petioles, leaf blades or sap, while others want to know whether a result reported as 'low' means fertiliser should be applied. This article looks at how to choose an appropriate test, collect a representative sample, and interpret the results.

The most useful tissue analysis programs are built on representative sampling, appropriate interpretation standards, consistent monitoring and good vineyard records.

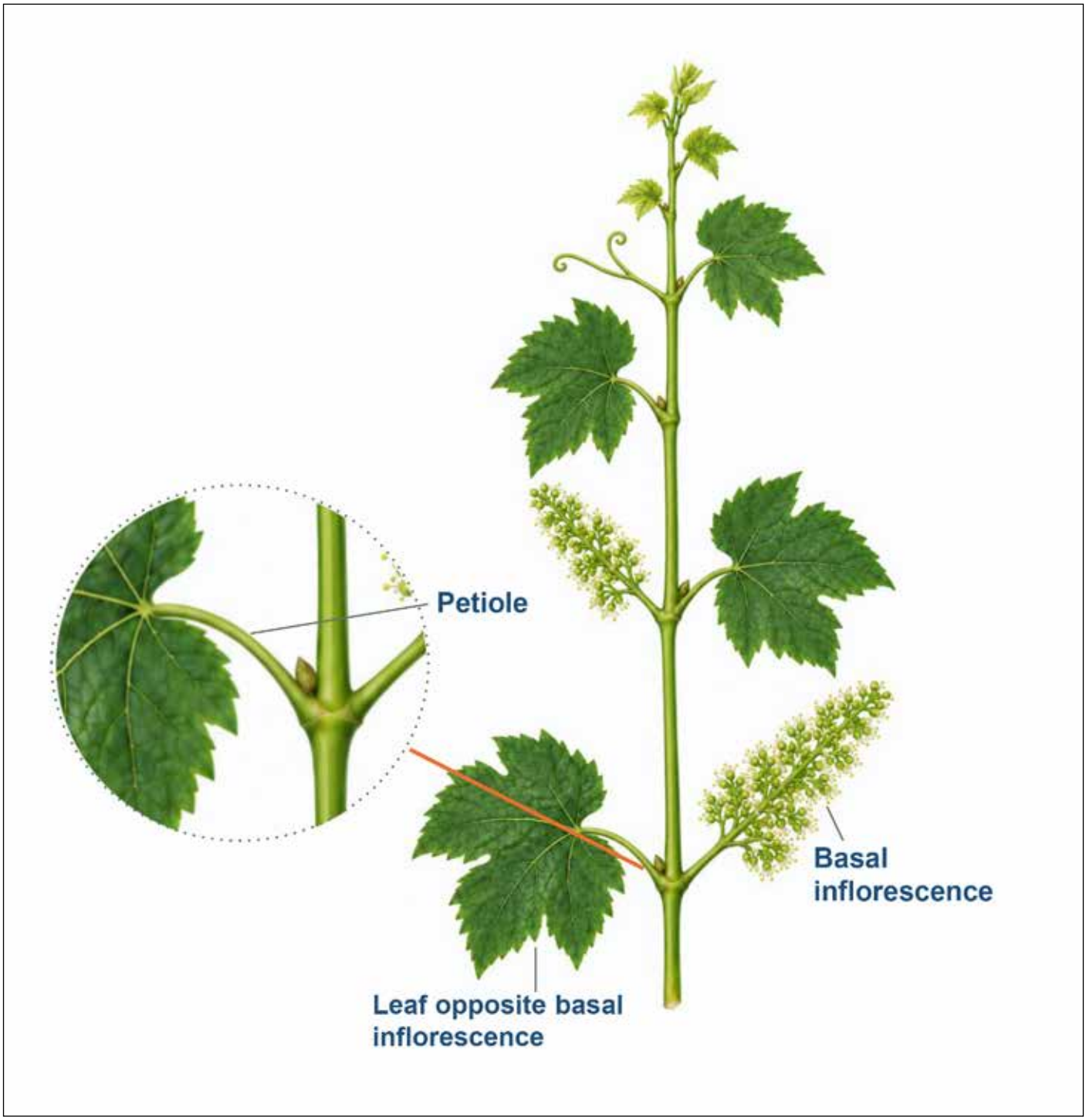


Figure 1. Petiole sampling position at flowering (E-L 25; approximately 80% capfall). Collect the whole petiole from a leaf opposite a basal inflorescence.

What can tissue analysis tell you?

Tissue analysis measures the concentration of nutrients within the sampled part of the vine at a specific time or phenological stage. The results can be used to monitor nutrient status over time, investigate suspected deficiencies or toxicities, and assess changes following fertiliser application or other management practices. When collecting samples and evaluating results, it's important to understand the range of factors that can contribute to variability. These include but are not limited to tissue type, variety, clone, rootstock, vine vigour, crop load, seasonal conditions and timing of sampling. Sample collection during the period of rapid shoot growth, for example, can result in dilution of nutrient concentrations in leaves and petioles. Because of these influencing factors, a tissue analysis result should therefore be used as supporting evidence, rather than as a standalone fertiliser prescription.

Combining tissue and soil analysis can provide a more complete picture of vine nutrition. Soil analysis provides information about soil conditions and extractable nutrients in the root zone, but it does not necessarily indicate the vine's current nutrient status. Nutrient availability and uptake can be affected by soil moisture, pH, salinity, compaction,

root health, temperature and interactions between nutrients.

What are the different tissue testing options?

Tissue testing options include dried-tissue analysis of petioles or leaf blades, and petiole-sap analysis.

Dried tissue analysis

Conventional dried-tissue analysis measures the total nutrient concentration in petioles or leaf blades. Samples are collected as fresh tissue in the field and then dried prior to analysis. Interpretation ranges for Australian winegrapes are available for a range of nutrients and established tissue and sampling-stage combinations, particularly petioles at flowering and leaf blades at veraison. Results from petioles and leaf blades are not interchangeable, even when they come from the same leaf.

Sap analysis

Sap analysis measures soluble nutrients extracted from fresh plant material. Australian research has developed petiole-sap methods for nutrients including nitrate and potassium. Because sap results are particularly sensitive to sampling, handling, vine water status and extraction methods, follow the laboratory's sampling protocol carefully. Interpretation ranges for comprehensive sap analysis are not as well established for Australian winegrapes as those for conventional dried-tissue analysis.

> Because of these influencing factors, a tissue analysis result should therefore be used as supporting evidence, rather than as a standalone fertiliser prescription. Spiro Papadopoulos

Results of tissue testing options are influenced by the tissue sampled, sampling time and sample handling, with sap results also particularly sensitive to vine water status and extraction method. Results from different analytical methods are not directly comparable and should be interpreted using reference ranges developed for the relevant tissue, growth stage and method.

Which tissue should you sample and when?

For routine nutrition monitoring, petiole analysis at flowering is the most established approach in Australia. Collect whole petioles at E-L 25 (approximately 80% capfall) from leaves opposite basal inflorescences. Given Australian research has found that nutrient concentrations vary along the length of the petiole, it is important that the entire petiole is collected during field sampling.

Leaf blades are generally sampled at veraison in Australia. Some laboratories may also offer leaf-blade analysis at flowering. Ensure the results are compared to appropriate ranges specific to the tissue, growth stage and sampling position.

How do you collect a tissue sample?

Routine monitoring

For routine nutrition monitoring, identify a uniform sampling area. Blocks with different varieties, rootstocks, soil types, irrigation zones and management histories should be sampled separately. Problem areas should be sampled separately from 'normally' performing parts of the block. Check the laboratory's sampling methodology prior to beginning sample collection and take note of the required sample size and sample handling information.

Follow a systematic path through the sampling area to collect a representative tissue sample, rather than collecting from a few convenient vines. A sample of around 100 petioles or leaf blades is commonly required, although this may vary between laboratories. For petiole analysis, select petioles from leaves



opposite basal inflorescences, taking care to collect the whole petiole.

Place samples in the packaging specified by the laboratory, label clearly and submit promptly. Take care to avoid sample contamination from dust, soil, foliar fertilisers, nutrient-containing fungicides and sunscreen, as these can affect the results. Wear clean, powder-free disposable gloves when handling vine tissue and follow the laboratory's instructions for collection, cleaning, packaging and transport.

Problem diagnosis

For problem diagnosis, paired samples from symptomatic and healthy vines may be collected outside the standard sampling stages. In these cases, interpretation may rely more heavily on comparison between the two groups rather than usual reference ranges. The two samples should be as comparable as possible in variety, rootstock, vine age, soil and management. Collect equivalent tissue from the same shoot position during the same sampling visit and record the growth stage of each group. If the groups are at different growth stages, note this when submitting the samples and interpret the comparison with caution.

The results are back. What should you do next?

Review the results alongside the interpretation ranges provided by the laboratory for the tissue type, growth stage and sampling position. Petiole, leaf blade and sap results should not be directly compared because they require different interpretation.

Consider the results alongside the condition of the vineyard, vine appearance, shoot growth, yield, fruit composition, previous results and management history. A value reported as low or high does not, by itself, confirm a deficiency or toxicity.

What if the results don't match what you can see in the vineyard?

If vines are not showing any symptoms of deficiency or toxicity, yet the results indicate otherwise, other factors may be involved such as limiting soil conditions. For example, dry or waterlogged soil, pH extremes, salinity, compaction, root disease or poor irrigation performance may restrict nutrient availability or uptake. Sampling error, contamination, rapid vine growth, variety and rootstock can also affect the results. Applying additional fertiliser without identifying the underlying cause may not solve the problem.

Should you apply fertiliser if the results are low?

The answer is not necessarily. Nutrient requirements and safe rates of fertiliser application vary considerably depending on growth stage and nutrient type. For some micronutrients, the difference between deficiency and toxicity may be relatively small. If you need help interpreting results or deciding whether corrective treatment is needed, seek advice from a viticulturist or agronomist, or contact the AWRI helpdesk.

How to access help

The AWRI helpdesk provides a technical advisory service for Australia's grapegrowers and winemakers. For free and confidential advice, call (08) 8313 6600 or email helpdesk@awri.com.au.

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References and further reading

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