



Current titles in this Grapevine nutrition VitiNote series include:

1. Nitrogen fertilisation
2. Phosphorus fertilisation
3. Petiole analysis
4. Potassium fertilisation
5. Soil acidification
6. Liming
7. Trace elements

Grapevine nutrition 2: Phosphorus fertilisation

MOBILITY AND AVAILABILITY IN SOILS AND THE VINE

Phosphorus (P) is available via the slow breakdown of organic materials in the soil, or as an applied fertiliser. Most soils used for viticulture in Australia have low native concentrations of phosphorus and therefore phosphorus fertiliser inputs are normally required.

Phosphorus is taken up by vines from the soil water in its soluble phosphate form.

- Phosphorus is not readily leached from the root zone in most soils, but availability is reduced when it is 'fixed' in a soil by reactions with high levels of calcium, iron and aluminium. It can also be bound to organic matter and soil particles, making it slowly available to vines.
- Where phosphorus has been applied, soil reserves may be sufficient for long periods as this mineral is relatively immobile in most soils.

Phosphorus is mobile within the grapevine, and can be moved from mature organs to areas of new growth. This gives rise to deficiency symptoms first appearing on older leaves, which may fall prematurely.

SOURCES AND LOSSES

Once applied, phosphorus can remain in the soil profile for a considerable time, however it can be

leached from sandy, acid soils and lost when surface soil is eroded. It has been estimated that around 0.6kg of phosphorus is removed at harvest per tonne of grapes.

NUTRIENT MANAGEMENT WITH PHOSPHORUS FERTILISERS

Phosphorus fertilisers are usually available in three forms:

- Water soluble
- Citrate soluble
- Citrate insoluble

The water soluble and, to a lesser extent, citrate soluble forms are available to plants relatively quickly, whereas the citrate insoluble form, e.g. rock phosphates, act as a slow release source of phosphorus and can take years to become available to vines depending on the pH of the soil. Phosphorus fertilisers containing the highest percentages of water soluble phosphorus have the most P readily available for use by vines (see Table 1 for P fertiliser characteristics).

APPLYING FERTILISERS

Consultation with your winery is always advisable when considering phosphorus applications.

Traditionally, superphosphate has been applied to soils by deep ripping prior to planting vines. However, a common method now used to apply phosphorus fertiliser prior to planting involves applying it with any applications of lime, organic matter

Table 1. Characteristics of selected forms of phosphorus-containing fertiliser products

Phosphorus form	Characteristics
Single superphosphate	<ul style="list-style-type: none"> • Contains sulphur and gypsum • High in water soluble (readily available) phosphorus • Non-acidifying
Double and triple strength superphosphate	<ul style="list-style-type: none"> • Higher phosphate content than single superphosphate • Granulated product, easy to apply • Some have added zinc
Mono-ammonium and di-ammonium phosphate (MAP and DAP)	<ul style="list-style-type: none"> • Readily soluble • Suitable for fertigation • Contains both nitrogen and phosphorus • Acidifying (generally not suitable on acid soils)
Phosphoric acid	<ul style="list-style-type: none"> • Suitable for fertigation • Safe handling issues • Acidifying (may not be suitable on some acid soils)

and gypsum in a band on the surface along the proposed vine row and mixing it into the soil.

The rate of superphosphate to apply should be determined with pre-planting soil tests. Although most Australian soils are naturally low in phosphorus, previous land use may have seen substantial amounts of phosphorus fertiliser applied to the soil.

When applying superphosphate to soils with low background levels of phosphorus (less than 25–30mg per kg Colwell P), additional P can be applied to the inter row for the cover crop or sward if required. (Seek advice on rates from a cropping or pasture agronomist as these will differ from the rates required by vines.)

Band application of phosphorus fertiliser is generally more effective than broadcast application. Banded fertilisers are applied in a narrow band along the under vine bank after weeds have been cleared, where the majority of vine feeder roots can be found. In low P soils the equivalent of 0.5–1.0 t/ha of single super phosphate is typically banded along the vine row.

Phosphorus fertiliser is best applied in autumn or early spring to take advantage of any rain to move it into the root zone. Some forms of phosphorus can also be delivered to vines by fertigation.

As phosphorus only moves away from the point of application very slowly, except on very sandy acid

soils, the application strategy must be thought out carefully to avoid fixation of the phosphorus in forms that are unavailable to plants. In some highly fixing soils, repeat applications of phosphorus fertiliser may be needed to saturate the fixation sites on the soil particles so that applied phosphorus fertiliser remains available to the vines.

TIMING APPLICATION FOR EFFICIENT UPTAKE

Pre-planting

Applications of phosphorus fertiliser prior to planting should be made on the basis of soil tests. If indicated, phosphorus fertiliser should be applied as a surface band along the proposed vine row and cultivated in. This increases the chance of young vines accessing the phosphorus.

Established vineyards

In established vineyards, periodic testing of plant tissue and/or soil for phosphorus is advisable to determine the current reserves of phosphorus in the vines and soil. Phosphorus fertiliser only needs to be applied when testing indicates it is in short supply.

It is important to ensure a supply of phosphorus is available for use by vines before the two major uptake periods, which occur:

- 3–4 weeks after budburst, and
- for approximately four weeks after harvest up to leaf fall.

Because of its key role in the reproductive processes of the vine, the application of readily available phosphorus early in the season, when phosphorus availability is limiting, can influence the number of berries per bunch and overall bunch weights. However, vines require adequate phosphorus throughout the growing season.

ENVIRONMENTAL AND SUSTAINABILITY ISSUES

There are various issues relating to both the sustainability of the phosphorus resource in a given vineyard and the use of phosphorus-containing fertilisers in the greater environment. These include:

- losses from the vineyard
- soil acidification (this has implications for the level of accessible nutrients, soil pH, and potential for aluminium toxicity in vines)
- phosphorus-induced zinc deficiency, and
- potential to cause algal blooms in waterways.

FURTHER INFORMATION

Product or service information is provided to inform the viticulture industry about available resources, and should not be interpreted as an endorsement.

This VitiNote has been prepared for growers who wish to apply phosphorus fertiliser. The decision to apply phosphorus may have been arrived at through visual observations of deficiency symptoms, from

petiole analysis or from soil analysis. For petiole analysis see VitiNote *Petiole analysis*.

Further detail on phosphorus sources, nutrition, deficiency symptoms and management can be found in the *Grapevine Nutrition: Research to Practice™* training manual, Cooperative Research Centre for Viticulture, Adelaide 2005.

Useful references on these topics are:

- Robinson JB, (1997) *Grapevine Nutrition*, in *Viticulture Vol 2 Practices*, Eds Coombe BG & Dry PR, reprinted 2001, Winetitles, Adelaide, pp178-208.
- Nicholas P, (Ed.) (2004) *Soil, irrigation and nutrition*, Grape Production Series 2, SARDI, Adelaide.

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