

The Good Earth by Nick Hoskins

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What can viticulturists do to preserve and promote soil health?

The French word “terroir” refers to the complete natural environment in which a particular wine is produced – including the soil. Although it’s an essential component of viticulture and winemaking, soil condition doesn’t always get the attention it warrants – and that’s unfortunate, because there’s a strong correlation between soil and vine health.

Picture a cycle in which each benefit is passed on in one or more ways to enrich the whole. Healthy soils are conducive to root development, and a good root system will increase the vine’s access to soil moisture and nutrients, thus promoting shoot growth. In turn, good shoot growth maximises root development, since surplus sugars from the shoots are transported and exuded by the roots, thus feeding soil micro-organisms. A healthy/balanced population of soil micro-organisms not only aids the uptake of moisture and nutrients, it also protects the roots from attack by aggressive fungi and bacteria.

Conversely, poor soil health means that roots struggle to access moisture and nutrients, the vines become stressed, shoot growth is correspondingly poor, and fewer surplus sugars are available for export to the roots. The bad news doesn’t stop there. Stressed vines often lose their leaves before or immediately post harvest, and that translates into a lost opportunity for the carbohydrates in the leaves to be exported to the roots and trunk. These stored carbohydrates are very important, since they provide the “fuel” for bud break and initial growth of the vines in spring.

Science has not yet identified all the micro-organisms present in soil, but the United States Department of Agriculture (USDA) Natural Resources Conservation Service (NRCS) estimates a healthy agricultural soil should contain:

- 100 million to 1 billion bacteria (per gram)
- Several yards of fungi, dominated by vesicular-arbuscular mycorrhizal fungi (commonly referred to as “VAM”) (per gram)
- Several thousand flagellates and amoebae, one hundred to several hundred ciliates (per gram)
- 10 to 20 bacterial feeders, a few fungal feeders and a few predatory nematodes (per gram)
- Up to 100 arthropods (per square foot)
- 5 to 30 earthworms (per square foot)

Wine-grape production is classic “monoculture,” demanding frequent intervention to produce that single crop year in, year out. Much of our current arsenal – in terms of controlling pathogens (fungicides), weeds (herbicides), and adding nutrients to the soils or leaves – can also damage the beneficial micro-organisms that inhabit the soil and leaves of our vineyards.

Despite those limitations, the viticulturist can nonetheless help to preserve and promote soil health, especially at the pre-planting stage.

Vineyard development

Soil preparation is an important step in this phase, and any earth movement should be done

carefully to try and preserve soil structure. Ground should not be worked up or planted when too wet or too dry. Pre-planting is also your sole opportunity to enrich soil with less mobile nutrients by incorporating (through cultivation) additions such as lime to improve pH, rock phosphate to increase Phosphorus levels, or gypsum (in conjunction with overhead irrigation) to reduce sodium or salt problems.

Beneficial micro-organisms can also be used to assist in the uptake of nutrients and suppress antagonistic soil pathogens during the vines' establishment. There is good evidence (both scientific and anecdotal) that Trichoderma and/or Micorrhizal fungi will do this. The following treatment is recommended for new and replacement vines, and comes courtesy of Grower Business Development Manager Dr Rengasamy Balasubramaniam (Dr Bala) at Delegat's Wine Estate.

Dip vine roots (still in the bundles) in the treatment, ensuring roots are coated. This mixture needs to be continually agitated to keep it in suspension (use an electric or battery drill with a paint mixer attachment):

- Mycorrmax 1kg (symbiotic Mycorrhizal fungi)
- Superzyme 1kg (2 strains of beneficial Trichoderma fungi and 2 species of beneficial bacteria)
- Zeba 1kg (super absorbent polymer based on natural cornstarch that helps the mix adhere to the vine roots and then slowly releases moisture after planting)
- 125 litres of water

Once vines are planted, they need to be free of competition during the establishment phase, so weeds must be controlled with herbicides. The

inter-row, however, can be sown rather than left bare. There are a number of options here: permanent grass sward, or a selection of plants that produce plenty of green matter that can be incorporated into the soil and/or mulched and placed in the vine rows.

Established vineyards

Balanced nutrition and good pH favour the development of soil micro-organisms, and vines with good nutrition will in turn produce good shoot growth that generates the exudates to encourage beneficial organisms. Many of the fertilisers we use today, however, tend to break down quickly and acidify the soil. Fertilisers such as reactive rock phosphate break down more slowly, but there's a corresponding delay before they're available to the plants.

Suspension fertilisers can be used to good effect if more immediate results are required. This type of fertiliser uses finely ground particles mixed with water to carry it into the soil. Fertigation can also be used to deliver soluble nutrients to the root zone to fix deficiency problems – although I would not recommend continued use. Eventually, this delivery system will acidify soil in the drip zone.

Stress from weeds (through competition for moisture and nutrients) is detrimental to vine performance and health. The traditional option – controlling weeds with herbicides – remains convenient and cost effective, but the acidifying action of herbicides can damage soil micro-organisms with prolonged use. Soil structure is further compromised by damage from rain, wind, and sun on bare earth.

That's why it makes sense to reduce herbicide use, particularly over the winter period when weeds have no impact on vine growth. Using mulches can help replace organic matter and

also help to reduce herbicide use. Side-throw mowers help to cover bare earth and put some organic matter under the vines.

Compaction from tractor wheels is another concern, particularly in soils that are naturally prone to packing (soils low in organic matter and/or fine soil particles). Try not to drive on wet soils, and remember that your choices in terms of tyres, machinery weight, and the number of passes all play a role in the degree of compaction.

Cultivation can also have a detrimental impact on soil structure. While cultivated vineyards are rare these days, cultivation is still used as a passive frost protection. To minimise the damage to soil structure and soil micro-organisms, sow crops after the danger of frost has passed to keep soil covered during the rest of the season.

Adding organic matter to the soil is difficult and costly, especially on a large scale. Over time, however, mulching prunings, growing cover crops, and side mowing to cover the herbicide strip will all help to improve the soil's organic matter. Adding good compost will increase soil micro-organisms and add nutrients. Even though

only a small amount of good compost is needed to have an effect, it can be difficult to source or make enough of it to apply to large vineyards. Thanks largely to the work carried out by the Soil Foodweb Institute (SFI), a growing number of viticulturists have become interested in compost tea as a means to increase/replace soil micro-organisms.

Compost tea brewing extracts the micro-organisms present in the compost and multiplies them using oxygenated water with additional food sources (such as humic acids). While there is nothing new about compost tea (it's been an integral part of organic and biodynamic practice for many years), it's now becoming more mainstream. Off-the-shelf products typically contain Mycorrhizal fungi, the benefits of which are well documented.

Managing a vineyard now includes managing vineyard soils. While we may never fully understand the complexities of soil biology, prudent viticulturists are taking care of our most valuable asset – the soil.

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