Potential rootzones - where are your roots?

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Welcome to Soil Horizon, the first of a semi-regular column in which Geoff Kew will draw on his 20 years of experience looking at soil profiles in vineyards and other horticultural and agricultural enterprises – covering the wine industry boom times of the 1990s to now when redevelopment of vineyards is being considered – to discuss how soil effects vine growth, fruit production and quality. Such discussions are particularly timely given that 2015 is the International Year of Soils.

The most time efficient way to observe vine root growth in the field is to excavate backhoe pits near the base of a vine or vines. Observing vine root growth in different soil materials in the field provides information that is not available from spatially-derived computer imagery and analysis. After the backhoe has finished you will need to clean the face of the soil pit to remove the smear marks from the backhoe bucket, and this will expose vine roots and the soil structure and horizons. The exposed vertical face will allow not only observation of where vine roots are growing, but will also show the different soil materials. Make a note of the depth of soil changes and in which soil materials the roots are growing. In most cases the sandy and or loamy topsoil materials above clay, soil carbonate or weathered rock will have most of the finer (1-2mm thick) roots and there should be too many to count. The larger medium-size roots (2-5mm thick) will be found in the subsoil materials.

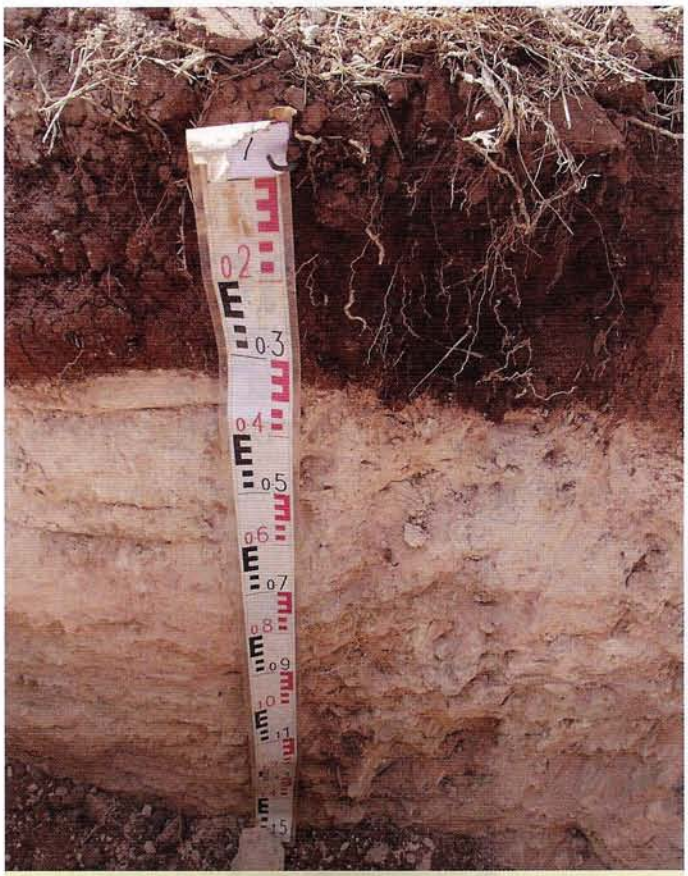
In general, some of the guidelines below can be used to determine how far vine roots will grow in a new vineyard soil. The topsoil materials will be colonised by vine roots. Topsoil in the context of this article refers to the 'A' horizon sandy and loamy soil textures (sand, loamy sand, sandy loam, sandy clay loam, clay loam) that overlie a 'B' horizon which may be clay, soil carbonate or weathered rock. If the clay is well structured and friable, vine roots will go about 50cm but if it is poorly structured and not permeable root growth is restricted to about 20cm. If the 'B' horizon contains soil carbonate that is sandy and loamy, then up to 50cm of that material would be colonised but only about 30cm if it is clay. The depth of vine root growth in weathered rock will depend on the angle of the rock fractures and the amount of soil material between the fractures, but vine roots will usually colonise 70cm of weathered rock. Other factors that may restrict vine root growth include soil chemical problems such as soil salinity, dispersion and sodicity.

I have included three common soil types seen in vineyards across Australia, as obviously we could not include all soil types in this article. Have a look at the soil profiles and the information I have provided and determine what depth you think vine roots will reach in these soils, assuming there are no soil chemical problems. I work on where the bulk of the roots will be and do not include odd roots scattered here or there.

THE ANSWERS

The shallow calcareous Chromosol (Figure 1) has 10cm of clay loam topsoil over well-structured friable sub-angular blocky clay that is 20cm thick. The roots should colonise all the topsoil and 20cm of the clay and then go another 30cm into the clay loam soil carbonate. The vine roots will not go 50cm into the soil carbonate as they have already travelled through the structured clay above. The potential rootzone in this undeveloped site would then be 60cm.

The moderately deep Sodosol (Figure 2, see page 60) has two topsoil layers. The first is sandy clay loam to 20cm and the second is 25cm of loamy sand to a depth of 45cm above clay. The second layer has been leached resulting in a



- 10cm of clay loam, over
- Permeable red sub-angular blocky clay to 30cm, over
- Clay loam soil carbonate with 70% siltstone gravel to 80cm, over
- Clay loam soil carbonate with 75% siltstone gravel to 150cm.

Figure 1. Shallow calcareous Chromosol soil, similar to Terra Rossa. Photo courtesy Tait Wines

- Sandy clay loam to 20cm, over
- Loamy sand to 45cm, over
- Prismatic (rectangular columns) structured light medium clay to 80cm, over
- Prismatic medium clay to 115cm, over
- Angular blocky (house brick-shaped) medium clay with some soil carbonate to 150cm.

Figure 2. Moderately deep Sodosol soil. Photo courtesy Advanced Viticulture & Management

bleached colour due to ponded water on the clay below this layer. It is now mainly composed of quartz grains. The clay below the topsoil is poorly structured (prismatic) and will limit water movement and vine root growth. It may also be sodic and dispersive and would probably benefit from ripping and deep gypsum placement (a topic for another article). Vine roots will struggle in the clay and may only reach another 20cm. The potential rootzone for this soil profile is then 65cm and is, in fact, greater than Figure 1 due to the deep topsoil of 45cm.

The Chromosol or duplex soil (Figure 3) has a permeable, friable structure and 25cm of topsoil comprising 10cm of sandy clay loam, and a second sandy clay loam horizon with 25% gravel and pebbles of weathered rock. The clay below is friable and permeable with an angular blocky structure; vine roots should go 50cm into this material, giving a rootzone of 75cm.

The discussion above shows that vine rootzone depth will vary with the soil materials while topsoil depth is critical in determining how far roots will grow. This data is important for determining readily available waterholding capacity across the vineyard. WVJ

- Sandy clay loam to 10cm, over
- Sandy clay loam with 25% siltstone gravel to 25cm, over
- Angular blocky (house brick-shaped) medium clay to 65cm, over
- Light medium clay soil carbonate to 100cm, over
- 80% weathered siltstone and sandy clay loam in fractures to 150cm.

Figure 3. A Chromosol soil – a duplex or texture contrast soil with permeable and friable structure. Photo courtesy Barossa Valley Estate