There are about a dozen major areas in which decisions must be made prior to the development or redevelopment of a vineyard. These include:

- site
- variety
- rootstock
- trellis design
- need to cope with soil-borne nematodes or disease
- irrigation design
- water quality
- need for artificial drainage
- frost
- wind
- soil amendment
- basal nutrition

Decisions about soil amendment and nutrition can to some extent be joined together with thinking about irrigation design and drainage.

Because a vineyard can reasonably be expected to exist for 20 to 25 years it is clearly to the grower’s advantage to get these things right before the vines go into the ground. It is necessary to ensure that:

- The investment is secure. This should be true whether working on one’s own account or as part of a corporate development.
- The vineyard is brought into production at the earliest opportunity. Lester (1990) points out just how critical decisions made before planting can be in altering the payback period of a vineyard development.
- One rules out the need to pick up the pieces after one or more seasons have gone by. Correction of acidity or soil structural problems after vineyards are planted is almost impossible.
- Savings are made where appropriate. Why apply basal fertilizer or lime if is not needed?
- Risk is managed as well as possible.
- Productivity reaches the projected estimates.

The purpose of this paper is to identify the range of sources of information and tests which are available to prospective vineyard developers or redevelopers, and to put them into a checklist framework which will help in decision making.

Information sources

The information sources available include:

- local knowledge
- soil maps and other published sources
- soil pits
- soil testing
- experience

I will examine each of these in order.
be determined by the complexity of the landscape.

There may be a statutory requirement for soil mapping which must be fulfilled in the development of an irrigation management plan. If a new area is being developed or if an extension of an irrigation licence is being sought, in such cases the expected level of sampling and detail of soil mapping should be ascertained before work commences.

Soil chemical analysis

Some chemical soil testing should be carried out in any new development or redevelopment project. The sorts of soil tests which are available can be classified as follows:

- Basic
  Usually a basic soil test provides pH, extractable phosphorus and potassium, salinity (based on a 1:5 soil:water extract) together with organic carbon or total soil nitrogen as a measure of soil organic matter. Tests such as this allow decisions to be made about basal phosphorus applications which may be designed to last the vines for a number of years. If such an application is not required, then it may be possible to save $200 per hectare in development costs. Inferences can also be made about the need for potassium fertilizer now or in the future and any potential salinity problems, but soil pH is probably the most important of the information available from a basic soil test. Lime application rates can then be set on the basis of informed local knowledge and experience.

- Extended soil test
  This type of soil test provides the same range of tests as detailed above, together with measurements of exchangeable cations and extractable trace elements. The additional information on exchangeable cations and extractable trace elements from extended tests can help in understanding the magnitude of an acidity problem by providing information on the potential buffering power of the soil. Extractable trace element data can give an indication that special effort should be put into (for example) foliar sprays to supply zinc, manganese and possibly copper to rapidly growing young vines.

- Specialist soil tests
  These might include conductivity of the saturation extract (EC), which gives a better measure of soil salinity than the EC 1:5 value mentioned earlier as it takes texture into account. Other specialized tests include lime requirement and gypsum requirement. These two, however, have often been developed for particular soils and if used in other environments they should be interpreted with caution.

Chemical soil tests do not provide information which can be used directly in understanding the fertilizer needs of vines because the tests have not been "calibrated" for vines, but they can provide indications as to various aspects of fertility which lead to "best guess" recommendations. For this reason, it is important to have the data from a chemical soil test interpreted by someone who is familiar with the particular soil and also familiar with the requirements of grapevines.

What standards should be used to interpret the data? A soil test provides important information for making decisions about basal fertilizer applications and also familiar with the requirements of grapevines.

Physical soil tests

The most useful physical test is for dispersion and slaking, (see for example the Victorian and New South Wales extension literature on the topic of optimizing soil structure). A aggregates from soils which require additional inputs of organic matter fly apart very rapidly when dropped into distilled water, but soils which require gypsum show a dispersion of the clay throughout the water after a few hours. This test can readily be done at the vineyard and does not have to be done by a laboratory.

Table 1. Development in a 'new' area - required action

<table>
<thead>
<tr>
<th>Concerns</th>
<th>Essential</th>
<th>Acceptable</th>
<th>Maximum</th>
</tr>
</thead>
<tbody>
<tr>
<td>Site selection</td>
<td>Aerial photograph, Reconnaissance survey, using soil auger, etc.</td>
<td>Aerial photograph, Reconnaissance survey, using soil pits, Specialist inputs</td>
<td></td>
</tr>
<tr>
<td>Irrigation design</td>
<td>Divide area by soil types and discuss with designer</td>
<td>Delineate carefully areas of similar rootzone depth and water holding capacity and insist that this information is used in irrigation design</td>
<td>Obtain a full soil survey, including contour maps and maps of areas with similar rootzone water holding capacity. Irrigation design optimizes control allowing independent watering of different areas.</td>
</tr>
<tr>
<td>Fertility, esp. need for basic fertilizer application</td>
<td>Basic soil test, Use laboratory advice.</td>
<td>Extended soil test, Use experienced advice to set rates.</td>
<td>Extended soil test, Test subsoil too, Use experienced advice to set rates.</td>
</tr>
<tr>
<td>Soil salinity</td>
<td>A s above</td>
<td>A s above</td>
<td>A s above</td>
</tr>
<tr>
<td>Soil acidity</td>
<td>A s above</td>
<td>A s above</td>
<td>A s for soil fertility, Can use lime requirement test.</td>
</tr>
<tr>
<td>Trace elements</td>
<td>Take no chances - if soil is alkaline, apply trace element sprays.</td>
<td>Take no chances - if soil is alkaline, apply zinc and manganese foliar sprays.</td>
<td>If soil test shows high extractable values no action is required.</td>
</tr>
<tr>
<td>Need for organic matter or gypsum</td>
<td>Routinely apply chicken litter or similar.</td>
<td>Check slaking and dispersion of the clay thorough the profile.</td>
<td>If lab does slaking and dispersion tests use these data as aid in decision making.</td>
</tr>
</tbody>
</table>
Experience
In any district there exists ‘local knowledge’ which often can be very important at the time of vine establishment. This includes:

- The need for regular nitrogen (perhaps as often as fortnightly) during establishment of young vines, particularly where drip irrigation is used.
- The need for regular foliar sprays like zinc, manganese and even copper on areas where soils are strongly alkaline.

In the past, some difficulties in establishing vineyards have been encountered when insufficient attention has been paid to information about the varying nutrient-supplying power of soils on a district-by-district basis.

Table 2. Development in an ‘established’ area - required action

<table>
<thead>
<tr>
<th>Concerns</th>
<th>Essential</th>
<th>Acceptable</th>
<th>Maximum</th>
</tr>
</thead>
<tbody>
<tr>
<td>Site selection</td>
<td>Aerial photograph. Discussion with informed local sources. Reference to available soil maps.</td>
<td>Aerial photograph. Reconnaissance survey, using soil auger or dig stick, preferably in company of specialists</td>
<td>Aerial photograph. Reconnaissance survey using soil pits with specialist input</td>
</tr>
<tr>
<td>Irrigation design</td>
<td>Divide soil into obvious classes and discuss with designer. Ensure that design takes account of differences in water holding capacity.</td>
<td>Aerial photograph. Reconnaissance survey using soil pits with irrigation designer.</td>
<td>Obtain a full soil survey, including contour maps. Irrigation design optimises information on water holding capacity of the rootzone.</td>
</tr>
<tr>
<td>Fertility, esp. need for basal fertilizer applic.</td>
<td>Basic soil test. Use laboratory advice.</td>
<td>Extended soil test. Use experienced advice to set rates</td>
<td>Use local knowledge to decide if specialist soil test is worth doing. Extended soil test. Test subsoil too. Use experienced advice to set rates</td>
</tr>
<tr>
<td>Soil salinity</td>
<td>Aerial photograph.</td>
<td>Aerial photograph.</td>
<td>Aerial photograph.</td>
</tr>
<tr>
<td>Soil acidity</td>
<td>Aerial photograph.</td>
<td>Aerial photograph.</td>
<td>Aerial photograph.</td>
</tr>
<tr>
<td>Trace elements</td>
<td>Basic soil test. Use laboratory advice.</td>
<td>Extended soil test. Use experienced advice to set rates</td>
<td>Use local knowledge to decide if specialist soil test is worth doing. Extended soil test. Test subsoil too. Use experienced advice to set rates</td>
</tr>
<tr>
<td>Need for organic matter or gypsum</td>
<td>Routine application of chicken litter or similar and gypsum depending on, local knowledge.</td>
<td>Check slaking and dispersion yourself and apply chicken litter and/or gypsum if needed.</td>
<td>If lab does slaking and dispersion tests use these data as aid in decision making.</td>
</tr>
</tbody>
</table>

Table 3. Redevelopment in an ‘established’ area - required action

<table>
<thead>
<tr>
<th>Concerns</th>
<th>Essential</th>
<th>Acceptable</th>
<th>Maximum</th>
</tr>
</thead>
<tbody>
<tr>
<td>Site selection</td>
<td>Close inspection of the property may be all that is necessary to identify problem areas. Discussion with informed local sources, and reference to soil maps may also be useful</td>
<td>Reconnaissance survey, using soil auger or dig stick, preferably in company of specialists</td>
<td>Need for reconnaissance survey using soil pits with specialist input will be a matter of judgement.</td>
</tr>
<tr>
<td>Irrigation design</td>
<td>Divide soil into obvious classes and discuss with designer.</td>
<td>Aerial photograph. Reconnaissance survey using soil pits with irrigation designer.</td>
<td>Obtain a full soil survey, including contour maps. Irrigation design optimises information on water holding capacity of the rootzone.</td>
</tr>
<tr>
<td>Fertility, esp. need for basal fertilizer applic.</td>
<td>Basic soil test. Use laboratory advice.</td>
<td>Extended soil test. Use experienced advice to set rates</td>
<td>Use local knowledge to decide if specialist soil test is worth doing. Extended soil test. Test subsoil too. Use experienced advice to set rates</td>
</tr>
<tr>
<td>Soil salinity</td>
<td>Aerial photograph.</td>
<td>Aerial photograph.</td>
<td>Aerial photograph.</td>
</tr>
<tr>
<td>Soil acidity</td>
<td>Aerial photograph.</td>
<td>Aerial photograph.</td>
<td>Aerial photograph.</td>
</tr>
<tr>
<td>Trace elements</td>
<td>Basic soil test. Use laboratory advice.</td>
<td>Extended soil test. Use experienced advice to set rates</td>
<td>Use local knowledge to decide if specialist soil testing is required.</td>
</tr>
<tr>
<td>Need for organic matter or gypsum</td>
<td>Routine application of chicken litter or similar and gypsum depending on, local knowledge.</td>
<td>Check slaking and dispersion yourself and apply chicken litter and/or gypsum if needed.</td>
<td>If lab does slaking and dispersion tests use these data as aid in decision making.</td>
</tr>
</tbody>
</table>

Having collected information from a wide range of sources the question remains how best to use these data. The extent to which use is made of them depends on the developer’s approach to risk. In the attached tables I refer to three cases:

1. Development in an area in which no current vineyards exist (i.e. a ‘new’ area)
2. Development of land not previously used for grapes in an existing area (i.e. in which grapes are currently grown)
3. Redevelopment of an old vineyard in an established area

In each case, one can conveniently divide the extent of information gathering into three different levels. At the basic level one can identify information which is essential to collect. There are then two higher levels: the one that one considers to be acceptable in any set of circumstances, and a maximum level.
Introduction
High water use efficiency in vineyards will only be achieved if the design of the irrigation system used for distributing the water to each grapevine is acceptable, an accurate assessment of the soil water holding capacity of the vine rootzone is known and monitored, and the cultural practices used in the vineyard optimize the conversion of applied water into fruit.

The following paper discusses how optimal water use efficiency may be achieved and covers aspects of acceptable system and application efficiency and the influence of some cultural practices on water use efficiency. Some of the information presented here is sourced from the Grape Production Series Vineyard Irrigation edited by P. Nicholas and M. McCarthy, with contributions from many research and extension staff around Australia. This publication is funded by the Grape and Wine Research and Development Corporation, ACHIEVING OPTIMAL WATER USE EFFICIENCY 41

References


Winetitles; 121-126.

which may be necessary in some circumstances but perhaps not all. Careful examination of the tables will show that there are many pieces of required information common to all levels, but at the level of site selection and irrigation design in areas which are “established” more risks can be taken. This of course is particularly true where vineyards exist on both sides of a prospective area. Where no background information is available a reconnaissance survey of some kind should be a necessity, either before a contract is signed or as a condition of completion of a purchase contract.

In any case, it is important to know how much weight to give the information which is available. These tables may help in deciding that, too. (Please note that I have limited my items of concern to those that are probably most important in deciding on soil management approach and fertilizer use in a vineyard site.)

The final question which is often asked is ‘Can we afford to do this sort of work?’ A vineyard development in 1993 is likely to cost somewhere between $20,000 and $25,000 per hectare. A reconnaissance soil survey at the time that decisions are being made as to whether to purchase land might cost between $650 and $1,000 depending on the size of the site. A full soil survey and mapping could cost somewhere between $200 and $300 per hectare. A basic chemical soil test could cost between $30 and $50 per sample and a more detailed soil test (perhaps including some physical testing) could cost around $85 to $100 per sample.

The question which should be asked is ‘Can we afford not to collect appropriate information before developing a vineyard which will cost so much and can be expected to be in the ground for at least 20 years, and probably longer?’