Uniform Vineyards - the Search for Parameters

STEPHEN GUILBAUD-OUTON
Senior Viticulturist NSW/Vic, Orlando Wyndham Group

Introduction

The winegrape growing industry is becoming increasingly aware of the necessity to control the characteristics of vine growth. There is acceptance that the adoption of canopy management and regulated irrigation practices can influence the quality of grapes harvested and assist in the control of fungal diseases.

Implementation of these practices involves making measurements of vine characteristics and soil moisture and then reacting accordingly. The measurements are more significant and the reaction more effective when the block to which they pertain is planted on soils that are uniform.

In addition, Orlando Wyndham has seen an improvement in wine quality when homogenous lots of fruit are selected in the vineyard and processed separately. Variability in fruit produced from a block of vines has been observed to relate to the variability of irrigation output and soil characteristics within the block.

This paper reviews the current practices that are implemented to achieve more uniform vineyards and suggests parameters for the benchmarking of this uniformity. Indicators of soil variability in new vineyard developments are discussed.

Achieving block uniformity—existing vineyards

Blocks in existing vineyards can be subdivided so that each of the new blocks created is more uniform than the original block.

The most straightforward division of this type occurs where the variation occurs perpendicularly to the direction of the vine rows.

There are several options available to the manager:

- divide variable blocks for the purpose of harvest only.
- create separate blocks for management purposes by the installation of new headlands or changes to the irrigation system.

Best practice

The process involved in subdivision of existing blocks is as follows:

- measure block variability.
- compare block variability with a standard.
- implement block subdivision if required.

Indicators of uniformity

Block variability is normally readily apparent to the vineyard manager. The manager may notice variations in crop level during harvest, changes in vine vigour, or even differences in phenological timing throughout a block. An aerial photograph can also be useful in detecting changes in soil type, irrigation output and vine response.

One quantifiable indicator that encapsulates a broad range of causes of vineyard variation is the uniformity of ripeness across a block.

Orlando Wyndham has been measuring the uniformity of ripeness of loads of grapes delivered to each of its wineries for two vintages. Each load is divided into standard bins. Two measurements of Baume are made from each bin and recorded against the block from which the fruit was harvested. A verage deviation of Baume is then calculated for each block.

Parameters

Given this indicator of the variability of each block, the manager can decide whether any action is required to improve the result. Ideally, he or she should be able to compare their score with a standard that reflects the winemaker’s requirement. At this point in time, such a standard does not exist.

An alternative approach is to undertake a benchmarking process so that the manager can compare outcomes with other growers. To this end, each Orlando Wyndham grower is provided with a report that includes, along with their own results, district averages for variability of each variety.

In addition, it is possible to review the variability outcomes of a cross section of Orlando Wyndham deliveries for the 1996 and 1997 vintages. Prior to both these vintages, a considerable effort had been applied to identify separate patches on vineyards and subdivide if variation was visually apparent. Most subdivision occurred without changes to block layout. The results (Figure 1) can be regarded as achievable outcomes and can be used as a yardstick to determine what may be an acceptable block variation.

In both 1996 and 1997, approximately 54% of the deliveries analysed recorded an average deviation in Baume of less than 0.2, and 80% were delivered with an average deviation of less than 0.3.

Example

An example of the outcome of this process at block level is shown in Table 1.

In 1996, the average deviation of Baume of the block was 0.5. From Figure 1, it can be deduced that 91% of deliveries had lower average deviations. The major cause of the variation was easily explained by a considerable change in soil from one part of the block to the other. For the purpose of harvest in 1997, the block was divided into two sub-blocks, North and South. Fruit delivered from each sub-block had average deviation of Baume of 0.07 and 0.04 respectively.

Designing new vineyards

The viticulturist’s task when faced with bare ground, is to delineate blocks that will be practical to manage and produce

Table 1. Effect of block subdivision on average deviation of Baume

<table>
<thead>
<tr>
<th>Block</th>
<th>Average deviation of Baume</th>
<th>Average soil RAW</th>
</tr>
</thead>
<tbody>
<tr>
<td>Whole block</td>
<td>0.5</td>
<td>–</td>
</tr>
<tr>
<td>North</td>
<td>-</td>
<td>0.07</td>
</tr>
<tr>
<td>South</td>
<td>-</td>
<td>0.04</td>
</tr>
</tbody>
</table>

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in the early stages of vineyard planning. Typically these sur-
vines that are inherently uniform. He or she requires infor-

Figure 1. Average deviation of Baume of selected deliveries to

Qualified soil scientists are employed to conduct surveys

Current best practice—minimising block variation

Indicators of soil variability

Qualified soil scientists are employed to conduct surveys in the early stages of vineyard planning. Typically these surveys involve describing soil profiles to a depth of 180 cm at points on a 75 metre grid over the property. For each layer of soil, a range of characteristics such as colour, pedality, geology, expected root depth, and texture are recorded.

The soil scientist consequently assigns a figure to each pit known as the readily available water (RAW) value. This value is calculated by summing the RAW values for each texture layer in the profile to the anticipated root depth.

Of all the descriptors of the soil, the RAW is the most easily quantified. In addition, it includes three soil characteristics, those of texture, presence of coarse fragments and root depth, in its calculation. However, a given RAW value may have different consequences to irrigation scheduling and vine capacity when applied to soil profiles that are different in nature. For this reason, the soil scientists will also classify soil pits into groups that indicate their general type.

A number of classification systems are used by surveyors, ranging from Great Soil Groups to site specific groupings based on geology and the assemblage of layers.

The soil type classification provided by the soil scientist is often of too broad a nature to be used to divide vineyards. A range of soil profiles that can be quite different in their effect on vine growth and water regimes can be classified into one group. If this is considered to be the case by the vineyard designer, a unique classification system can be created that is relevant to the site. It is useful to divide soil types into sub groups according to the nature of the impedance to root growth and whether or not it is considered possible to impart moisture stress to vines growing in the profile. This involves a detailed review of all the data available for each soil pit. Typically, six or seven soil groups are created. One advantage of this technique is that RAW values for each pit are included to some extent in the classification.

The vineyard designer thus has available two indicators of soil variability that must be used in conjunction. RAW is conveniently quantifiable, but its value relies to a large extent on the ability of the soil surveyor to estimate vine root depth. The degree of soil type differentiation is dependent on the abilities of the viticulturist to distinguish characteristics that will significantly affect vine growth or management.

Current best practice—minimising block variation

Following the completion of the soil survey, a vineyard planting layout is drafted. A reas designated as unsuitable for viticulture by the soil surveyor are omitted.

The designer attempts to draft the layout so as to minimise variation of soil type and RAW within each block. The degree of variation achieved will be subject to the physical constraints of the site and criteria related to the practical management of the vineyard.

Layout of undulating sites is primarily determined by the location of headlands in waterways and other factors as required by soil conservation principles.

Practical considerations, such as minimum block size, row length, and continuity of varieties across headlands, are determined subjectively by those involved in the design process.
be considered reasonably similar within each block. The outlined in this paper will lead to vineyards that are more

Figure 2. Distribution of vineyard blocks in ranges of their average deviation of soil RAW (expressed as percentage of average RAW of each block).

a. Vineyards that have been designed to minimise block variability. Vineyards are located at three sites in Mudgee and Canowindra (NSW), and were designed in 1995 and 1996. Total vineyard area is 329 ha comprising 118 blocks.

b. Vineyards that have been subdivided into blocks after establishment to reduce block variability. Vineyards are located in South Australia (Barossa Valley, Eden Valley) and NSW (Mudgee and Hunter Valley). Total vineyard area 320 ha, comprising 95 blocks.

In search of parameters
It is easy to accept that vineyard blocks planted on uniform soil type is a desirable goal.

It is also apparent that the processes of vineyard design outlined in this paper will lead to vineyards that are more uniform than they would otherwise have been. Figure 2a shows the soil variability, indicated by the average deviation of RAW as a percentage of average RAW, in blocks in vineyards that have been recently designed. These vineyards are on undulating sites with layouts that are considerably affected by physical constraints. Most blocks are on soils that can be considered reasonably similar within each block. The average block size in these vineyards is 2.8 ha.

Over half the blocks have average deviation of RAW of less than 10% of their average RAW. The median deviation is 9.1%. This compares favourably with blocks that have been delineated from existing vineyards and have a median average deviation of 17% of their average RAW (Figure 2b).

However, the big question is how uniform should each block be? At many times during the process, the designer is faced with the decision whether or not to divide a notional block into sub-blocks. A parameter, an indicator of soil variability tolerance, is as yet elusive.

What also remains undetermined is how well the RAW variability on a uniform soil type relates quantitatively to the variability of grapes consequently produced. If indeed, such a relationship exists, how is it affected by factors such as climate, the average RAW or root depth in the block, or variety? Figure 1 shows that variability of deliveries of Shiraz is greater than that of other varieties. Could it be that Shiraz is more sensitive to soil variation or that irrigation scheduling strategies have had an impact?

Conclusion
Parameters to guide the design of uniform vineyards are not currently available. However, many plantings that have been designed to minimise soil variations will be in full production within the next three to five years. Each of these vineyards contains blocks that have relatively uniform soils and irrigation output. With these variables minimised, investigations into the questions raised in this paper will be possible.