

# Oregon Wine Advisory Board Research Progress Report

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## Could Canopy Management Techniques Improve Oregon Wine Quality?

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### INTRODUCTION

The phrase "canopy management" has recently become trendy in many New World grapegrowing areas. Interestingly enough, the concepts are not new and are generally acknowledged in Old World viticulture, though often these empirical observations are misinterpreted, as we will soon show. It was Nelson Shaulis of Cornell University who developed ideas of canopy management, especially for New World audiences, which culminated in his description in 1966 of the Geneva Double Curtain.

Shaulis' studies showed him that the primary limiting factor in modern vineyard production was sunlight, once pests, diseases, and weed competition were overcome. Widely spaced rows alternating with dense vine canopies was standard vineyard practice. While the exterior leaves were well exposed, there was a high proportion of shaded interior leaves and fruit, which was shown to have negative effects on both yield and fruit composition. The solution was to divide dense canopies, and he found that an improved trellis system was preferable to closer row spacing.

Although published over twenty years ago, there has been a reluctance to accept some of these basic biological principles. Probably a major reason was that the initial studies were with *Labruscana* grapes (Concord) and many believed the same results would not apply to *Vitis vinifera*, the European winegrape. Also, many believed that similar responses would not be obtained in "sunny" climates, like California or Australia. These same people had obviously never measured light levels in the center of dense canopies - they are equally low in "sunny" as in "cloudy" climates, and both inferior from a vine physiology point of view! Another major reason was the reluctance of researchers to evaluate other peoples' ideas or systems. This disturbing trend is still evident. While some may claim lack of mechanization as an impediment to local evaluation, it is noteworthy that Shaulis developed GDC for both mechanical harvesting **and** pruning.

There were, however, a few converts to the Shaulis approach. During the early 1970's, Dr. Cesare Intrieri of Italy, Dr. Alain Carbonneau of France, and I (Richard Smart of Australia) learned from Shaulis and further developed these ideas for *vinifera* winegrapes. The results were equally encouraging, and now, in the late 1980's, canopy management is being actively researched throughout the New World.

Over centuries of trial and error and empirical observation, the Europeans have determined vineyard factors important for wine quality - and, by the way, vineyard factors are regarded as more important than cellar practices generally! Several adages come to us from Europe, to wit: "A struggling vine makes the best wine" and the old favorite "High yield gives lower quality". I understand **why** there is support

for these ideas and recognize that they do represent reasonable observation. But, like most empirical dogma, they are not necessarily correct. They show association only and do not prove cause and effect.

A feature of both low vigor ("struggling vines") and low yields is that the canopies are open. That is, most leaves and fruit are exposed. As one increases yield, this is invariably accompanied by an increase in shading. Similarly, high vigor means long shoots and more and bigger leaves, and this also increases shading. Perhaps it is not the "high vigor" or the "high yield" that cause reduced quality, but more shading. This is the central idea to what we regard as proper canopy management.

The last two decades have witnessed many studies of canopy microclimate and effects on wine quality. These studies have demonstrated similar responses with a range of varieties and over a range of climates, from "hot" to "cool". I have personally witnessed experimental wine tasting where wine judges (competent enologists all) thought they were tasting wines from different regions and were impressed to learn they all came from the same vineyard, the only difference being in canopy management.

We might add a word here about our Ruakura philosophy of canopy management. Our primary aim is to improve quality. It turns out that as we improve quality by canopy management, yields also increase. We can live with that. Also, we are interested in mechanization. We believe the future lies in mechanization of **all** vineyard operations, including harvest, winter pruning, and summer pruning as well as cultivation and spraying. While we understand that Oregon growers are not at the moment as concerned with mechanization, that may change along with immigration laws in the future. Our goal is to maximize quality and minimize unit cost of production.

This article is written as a series of questions and answers - we anticipate the question, then answer it! Hope we get the questions right!

## **ARE THERE DENSE VINE CANOPIES IN OREGON?**

Although I have only visited Oregon three times, on each visit I have been impressed that some canopies are too dense. The use of vertical shoot positioning and trimming, and now leaf removal, are commendable (such practices are regarded as "new" in some parts of California). But, despite this, canopies can still be too dense. This occurs typically of fertile soils and where the vines are pruned to too many buds per foot of canopy. However, on lower vigor sites the problem may not occur. And we want to pay particular respect to the Oregon State University studies of "grassing down" as a means of devigoration as well as erosion control.

## **SO WHAT IF MY CANOPY IS TOO DENSE?**

You might think it impertinent for two Kiwis (one really an Aussie) to suggest that wine quality might be inferior in Oregon. But all regions have good wines and bad wines, and Oregon is probably no different. Consider the difference between your wine and the best available - what are the deficiencies? Is it lack of color? too much acidity? lack of fruit (varietal) character on nose and/or palate? lack of body? too high a malic acid content or pH?

All the above factors are known to be affected by canopy management. To wit, fruit from shaded canopies is known to have less color, phenols, fruit character, and sugar, and higher pH, K, and malic acid. And such fruit is also more prone to Botrytis bunch rot.

## **WHY BOTHER MEASURING MY VINEYARDS?**

Many of you are involved in enology as well, and you would be horrified if I told you to measure alcohol, acidity, pH, SO<sub>2</sub>, malic acid, etc. by putting your finger in the wine. Yet people don't want to go into their vineyards to make even the most basic quality assurance measurements. Measurement is the key to successful vineyard canopy management, as for all true quality assurance programs. Don't be afraid to go into the vineyard!

## HOW DO I TELL IF MY CANOPY IS TOO DENSE?

In August 1988, MAFTech cooperated with Oregon State University in giving a canopy management workshop at Bethel Heights. There were 80 or so people in attendance who were instructed in the following techniques. If you have any doubts about the techniques, contact Bernadine Strik of Oregon State University.

1. **Visual Inspection:** This is a complex way of saying look at your canopy. Can you see through it? How much of the fruit is exposed? Does the vine appearance suggest high vigor, with big, dark green leaves, plenty of laterals, and growing tips? These observations are best made between veraison and harvest and can be formalized into a scorecard, in much the same way that wine quality can be assessed with a scorecard. We assess eight characters, each having ten points, to give a total score of 80. The following table lists the eight characters and the desirable desirable values which give high scores.

**Table 1. Characters assessed in vineyard scorecard along with desirable values.**

Character assessed	Desirable value
Canopy gaps	40%
Leaf size	slightly small
Leaf color	leaves green, healthy, slightly dull and pale
Canopy density	leaf layer number one or less
Fruit exposure	60% or more exposed
Shoot length	shoots 10-20 nodes long
Lateral growth	limited or zero lateral growth
Growing tips	5% or less actively growing

Full details of the scorecard are available from Bernadine Strik at OSU. The scorecard, or derivations thereof, is now being used as a routine vineyard quality assessment guide by leading wineries in New Zealand, Australia, and California.

You will see that there are eight characters to be assessed. Of these, three relate to canopy microclimate, the rest to vine physiological status. The scorecard was developed from a study of high wine quality producing vineyards in Australia, the United States, New Zealand, and France, and incorporates our research and that of others.

Try it, you will like it. It only takes a few minutes and will teach you how to start looking at your vines in a new way. You may find with experience that you may need to modify a few characters or drop some or add some. But get out there and look!

2. **Point quadrat:** This technique is for those who like to be a bit more "quantitative". Simply take a sharpened thin metal rod and insert it into the canopy in the fruit zone. Do it at random, don't pre-select your target area. Then you simply count "contacts" of the needle with leaves or fruit. Make about 50 observations for each uniform part of your vineyard and you can calculate the proportions of exterior fruit and leaves.
3. **Other measurements:** There are other simple techniques which include sunfleck measurement, shoot leaf area measurement, and pruning weight measurement, but they will take too much time to explain here. Ask the folks at Oregon State University for details.

### **IF I HAVE A PROBLEM, WHAT CAN I DO ABOUT IT?**

There are three basic means of controlling canopy density which we will describe.

1. **Vigor control:** In many vineyards, excessive vigor is the problem. The vines get into cycles of becoming increasingly vegetative since shading becomes successively worse and fruit bud initiation is more and more depressed. Have you ever noticed that you get the best quality crop out of young vineyards, before they become too leafy? This is a common observation in Australia.

You can easily tell if your vineyard is too vigorous. In the summer, leaves are large and lateral growth is extensive, typically several laterals per shoot. Growing tips are present throughout the growing season. Pruning weights will be in excess of 0.5 kg/m row (about 0.516/ft row), and the ratio of vine yield to pruning weight will be less than 5.

Our experience with vigor control using rootstocks in New Zealand is limited. We find that soil fertility (water and nutrient supply) is more important than rootstock variety. In other words, spend time on soil selection rather than rootstock selection. European experience suggests that vigor control can be assisted somewhat by rootstocks. We are currently evaluating Riparia Glaire, 101-14 Mgt, 420 A, and others. We could not expect that the rootstocks discussed as being vigor controlling in California, i.e. S04, 110 R, etc. hold much hope as they are considered elsewhere to be medium to high vigor.

Certainly, one should consider grassing down to devigorate, as this moisture and nutrient competition is cheap and effective. However, we find in many of our fertile New Zealand vineyards it is not enough.

Our current research indicates that the most effective means of devigoration is by the "BIG VINE" system. That is, prune that vine to many buds but give it, at the same time, a large canopy surface area. We find that vines "normally" pruned (up to 60 buds per vine) can be excessively vigorous and that this problem is overcome as we approach 150 buds or more per vine. We obtain shorter shoots, smaller leaves, and fewer lateral shoots and shoot tips - all desirable with BIG VINES.

We realize that many Oregon growers prune only to about 30 buds per vine and that bud numbers of 150 or so per vine would seem bizarre. However, there is no doubt that pruning

to small bud number for vigorous vines is the major cause of excessive shoot vigor. Also remember that our 150 buds are well spread out on long cordons, requiring 12 m (36') of cordon per vine. It is only by local evaluation you will find out the best bud number for your vineyard. We realize also that most Oregon growers favor cane pruning over cordon or spur pruning. Many of our growers have a similar perception, but they are misguided! Many experiments have shown that spur pruned vines yield about the same as cane pruned vines unless canopies are excessively dense. Also, spur pruned vines make it easier to establish a well spaced shoot system, essential for good canopy microclimate. And lastly, it is obviously easier to mechanize spur pruning than cane.

We do not believe in the use of growth regulators, i.e. CCC or ethephon. While it is perhaps convenient to add these chemicals to the spray tank, we do not see the need to add more chemicals to the vineyard. Let's use natural means!

2. **Shoot density control:** Where shoots are vertically trained, as in Oregon, New Zealand, and much of Europe, it is easy to understand that the closer shoots are spaced, the more dense will be the canopy. Leaves will overlap and there will be no "gaps" to allow sunlight in. On the other hand, if shoots are spaced too far apart, then there will be too many gaps and sunlight will be wasted - and potential yield is lost. So somewhere in between there is an ideal canopy with just the right amount of gaps - not too many, not too few. For average vigor vines, this figure is about 5 shoots per foot of canopy length (15 shoots/m), though for vigorous shoots the value will be lower. Our new training systems are pruned to about 5 buds per foot canopy, and since we have about 100% bud break, we end up with the correct shoot spacing.

Shoot thinning is a desirable practice which is widely used in California, but not elsewhere. In its simplest form it consists of thinning excessive shoots around the vine head, but where viticulturists are prepared to invest time and money, more thinning can be done. This includes removal of all non-fruitful shoots or thinning even fruitful shoots if the canopy is too dense (say, more than 5 shoots per foot). This is best done when shoots are about 15 cm (6") long.

A word here about leaf removal. If shoot density is too high, then leaf removal in the bunch zone will greatly improve cluster exposure. This should be done on both canopy sides between bloom and veraison, probably the earlier the better. You will find significant reductions in acidity and increase in color. Don't take off too many leaves - a maximum of 1-2 per shoot. About 60% of the fruit should be visible after leaf removal. If you have a nice straight wall canopy, you will find that machine leaf removal is a breeze -cheap and efficient.

3. **Alter your trellis:** There are many training systems to choose from and different growers have different criteria for selection. The available list includes the Scott Henry (developed in Oregon, made famous in New Zealand), "U" or lyre, GDC, Te Kauwhata Two Tier (TK2T), and Ruakura Twin Two Tier (RT2T), to name a few. The single curtain is now becoming popular in Oregon, and for vineyards of low to moderate vigor it works very well. We have had problems with this system for high vigor vineyards as it readily forms a cap of leaves over the cordon and the fruit zone can be excessively shaded. Generally, we find that vertical or nearly vertical canopy walls are preferred and that most of the systems can be mechanically pre-pruned, which saves pruning costs. We have found that canopy division by itself is no guarantee of a good canopy microclimate for high vigor vineyards. This is where we have been successful with the BIG VINE idea. We are evaluating removing every

second vine to increase bud numbers per vine with good results.

With the Scoff Henry, GDC, lyre, TK2T, etc. there are two feet of cordon for each foot of row length. If we want 150 buds, this takes **30** feet of cordon at 5 buds per foot. That is, vines spaced 15 feet apart. For RT2T, with four feet of cordon per foot of row, vines need be only 7'6" apart to achieve this bud number and shoot spacing. We are not saying that all sites are so fertile as to require 150 buds per vine, but this number is adequate for very vigorous sites. And when vineyards are young, vines may need to be "interplanted" so that early yield is not sacrificed, then they can be removed.

## CONCLUSION

Our experience has indicated that trellis change is the most economical way to improve grapevine canopies. Some growers react negatively to the idea of spending more on posts and wire, but our analyses show that this investment is well worthwhile. For example, the extra cost is typically recovered in one year's increased yield, let alone the quality improvement.

We plan to produce a canopy management booklet in 1989, and, hopefully, to hold a series of workshops in Oregon along with our engineers on building new trellis systems. The booklet will give details of trellis construction, etc.

Many growers we speak to are skeptical about canopy management and resist changing their vineyards. That is OK, but don't tell us we are wrong - prove it! We suggest you take a few rows - try several treatments, then make up the wine and judge for yourselves. Don't just say it won't work in Oregon - try it!