Oregon Wine Advisory Board
Research Progress Report

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Vine Improvement Research in New Zealand with Implications for Oregon

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INTRODUCTION

The planting operation is one of the most significant performed by the viticulturist, affecting as it does the future productivity and quality of the vineyard. Not only are decisions as to row and vine spacing of importance, but the most significant of all is the nature of the grapevines planted. I speak here not only of the important choice of scion and rootstock, but also the genetic and disease characteristics of the material planted.

Vine improvement is the major component of our viticultural research programme in New Zealand, and the reasons for this will be detailed below. I believe that Oregon can perhaps benefit from our experience as our industries are both young and developing.

PLANTING PROBLEMS IN NEW ZEALAND VINEYARDS

Most of the existing commercial vineyards were planted in a 'boom' during the mid 1970s. They were largely ungrafted (despite phylloxera being present in most of the regions) and cuttings were often in short supply. Planting material was taken haphazardly from commercial vineyards. As a result, many of these vineyards now show widespread virus diseases, the presence of rogue vines and effects of phylloxera. Our vine improvement research scheme started in 1982, against the background of wide spread phylloxera damage to vineyards in Gisborne, the largest grape growing area. Widespread planting to phylloxera resistant rootstocks was inevitable - in 1982, some 80% of New Zealand vineyards were own rooted. We realised that if we missed this opportunity to provide the industry with high health, genetically superior and correctly named planting material, then the opportunity would not arise again for 2-3 decades.

Where was this improved planting material to come from? We rapidly learned of the following problems which would require attention:

- Poor records of vines available for propagation as to virus status and clonal origin; Virus disease symptoms were widespread but there had been no systematic testing;
- Suspicion of incorrect naming;
- Absence of local clonal evaluation;
- Limited existing variety and rootstock evaluation;
- Limited range of improved material available locally despite common availability overseas;

- There was no system of distributing improved planting material to growers.

RESEARCH PROGRAMME COMMENCED

The research programme I will outline has included contributions from present and existing staff of the Ministry of Agriculture and Fisheries. DSIR Divisions of Plant Diseases, Horticulture and Processing, and Plant Physiology, and industry organisations. As well, we have benefited from advice by Dr. Austin Goheen of the University of California and Richard Cirami of the South Australian Department of Agriculture.

Development of a computer based vine register

There was no national accession list of grapevine importations into New Zealand at the time we commenced our work. We quickly learned of the inadequacies of the existing system in the industry of referring to 'Tombleson's clone of Mueller Thurgau' or 'Irwin's clone of Chardonnay', Tombleson and Irwin being Gisborne growers. Often these were in fact poly-clonal sources. We retrieved as well as we could the importation records which existed back to 1954 when quarantine was started. Prior imports to about 1900 were listed in the Annual Reports of the Department of Agriculture. Each importation was given a unique accession number - the initials TK (for 'Te Kauwhata') followed by a 5 digit number. Numbers were also allocated to existing vine collections at Te Kauwhata. We used the series:

TKO0001 -TK02999 Vines in the 'old' collection at Te Kauwhata
TK03000-TKO4999 Vines lost - that is imports could not be traced to an existing vine
TK0500-TKO5999 Vines released from quarantine from 1970-1981 in the Te Kauwhata collection
TK06000- Vines received since 1982

Currently we have a total of about 1,000 entries, which includes about 600 that are 'lost'. This unique accession number is the basis of our computer based register. For each entry we record the following information: TK number, name, clonal identification, synonyms, quarantine disease notes, post quarantine disease notes (including symptomology and recent indexing), importer, source, licence number, patent status and ampelographic queries.

Further, for each variety, there is a 'general text' which gives ampelographic references, variety suitability etc., including disease susceptibility. A separate 'specific text' refers to each clone of a variety and gives pertinent details of that clone, including local distribution. The computer system can be sorted by any sequence of characters desired. It will be available throughout the country on the MAF Prime network. Once this system was developed, we were readily able to see exactly what we had in the country, and what was the health and clonal status and availability.

Search for old imports

Grapevines were first imported into New Zealand in about 1819, along with one of the early missionary settlements. Marsden, Busby and Pompallier were all early importers. Busby had made extensive variety collections in Europe which form the basis of much of Australia's present vineyards, but unfortunately his vineyards in the Bay of Islands, New Zealand, were destroyed by warring Maoris. Early settlers also brought grapevines with them, including English migrants who introduced many table varieties out of 19th century glasshouses, including cuttings from the famous Hampton Court vine. Goldminers also brought vines from all over the world in the 1860s.

These early imports are of special significance to us because they are likely to be less infected with virus diseases than post 1900 importations. This is because it is widely considered that grafting to phylloxera resistant rootstocks in Europe in the late 1800s led to spread of latent virus diseases.

We have initiated public appeals to locate these old vines, and to date have 80 in our collection. Many have turned out to be Labrusca vines as these survive well in the wild, but we have located several viniferas. These include an apparently virus-free Pinot Meunier dating back to French missionaries in the 1860s, an unnamed black vinifera brought to Arrowtown by miners in the 1860s, and many old English table grape varieties. As these varieties are collected, they are named and virus indexed before distribution.

Ampelographic problems

We quickly became aware that some of our varieties were likely misnamed. In 1982, we sent descriptions, photographs and dried samples of 12 rootstocks to noted French ampelographers, Galet and Truel. We were informed of 5 likely naming errors: '41B' was '1202C'; '3309C' was '3306C'; '3306C' was 'l01-14 Mgt'; '8BB' was '1202C'; and '125-1' was 'Baco l' or '101-14 Mgt'.

Lack of industry support stopped us from arranging a visit by one of these ampelographers to New Zealand to look at other naming problems. This situation was overcome when Mrs. Doris Zuur took on M. Phil. studies at Waikato University in grapevine ampelography. Her field work commenced in 1985/86, and Doris has noted the following likely naming mistakes: Kishmish TKO0096; Gamay (de) Beaujolais (Pinot Noir); Muscat Alexandria (TKO0114); Olivette Blanche (TKO0128); Tannat (TKO0210). She has also located 101-14 Mgt in our collection which we thought was 'lost'. As well she is studying the effects of climatic variation on ampelographic characters. We regard this work as being very important, since a necessary first step in giving variety advice is to have the name correct!

Virus diseases

The following virus diseases were recorded in New Zealand by 1983: grapevine fanleaf virus, arabis mosaic virus, tobacco ringspot, and grapevine leaf roll. Recently our indexing programme has added grapevine corky bark, grapevine fleck and Rupestris stem pitting to this list.

Since virus diseases are generally spread by propagation, it is essential to identify infected plants and avoid their use in replanting. In New Zealand, we do not appear to have insect or nematode vectors which spread virus. Beginning in 1982, we noted virus symptoms in our collections as a first step to avoiding infected plants. We found that the majority of vines in the old collections showed virus symptoms. Subsequently, we began a virus indexing programme using Cabernet Franc, LN33 and Rupestris St. George as indicators, and have now indexed about 630 varieties/clones. Within two years, we will have completed this survey of our existing collections, and be in a position to offer certified plant material to the industry for propagation.

In cool climates such as Oregon and New Zealand, leaf roll virus has severe effects on yield and maturity. Studies in New Zealand have shown that yield may be reduced by 50%, and fruit sugar reduced by 2-3 ^{o}Brix. We have recently found that leaf roll virus severely reduces photosynthetic rate. We have found Rupestris stem pitting to be frequently present in imported material from Germany, although the effects of this virus are not known but are unlikely to be severe.

In 1987, we embarked on a major virus elimination programme. We have used thermotherapy and tissue culture for virus elimination. To date, about 130 varieties have been treated in a DSIR/MAF joint programme, and our vineyard at Rukuhia has 1,500 plants awaiting recording for virus symptoms and indexing. This collection will produce the majority of our certified plant material in the future. Once high health material is located, it is planted in an isolated, own-rooted Foundation vineyard.

Clonal selection

In 1982, we commenced a clonal selection programme for four winegrape varieties. In 1982, we selected

589 mother vines of the varieties Mueller Thurgau, Traminer, Chardonnay and Cabernet Sauvignon. For 1983 and 1984, we reduced this number to 279. In 1984, we grafted up clonal trials from all of these selections, comparing them with all imported clones. The first harvest will be in 1987, and we anticipate 5 crop years before recommendations will be made. Clones will be selected for both viticultural and oenological merit. Our trials include 18 clones of Cabernet Sauvignon, 21 clones of Mueller Thurgau, 27 clones of Gewurztraminer and 19 of Chardonnay. Once clones are released, they will be given a Ruakura number, i.e., clone RUA-2 Chardonnay. Clonal selection is an ongoing process and we will be continually selecting and evaluating new clones.

Importation
At the time we reviewed our vine collections in 1982, we found many deficiencies. Our range of rootstocks was limited - in fact, we had about half the number which were available in 1905! Further, for many commercially important varieties, we had limited or no imports of improved clonal material, and yet some clones had been imported several times (this was due to the fact that private individuals made the importations without knowledge of what was in the country). So we embarked on a large scale importation programme, although we were obliged to stay within an annual limit of 25 introductions. All vines remain in quarantine for 2-3 years, where they are virus indexed. Over the period 1983-1985, we initiated the following imports (often with several clones of each).

Rootstocks. Ramsey, 420A, 3306C, 34EM, 101-14 Mgt, 140 Ruggeri, 1103 Paulsen, 110 Richter, Riparia Gloire, 99 Richter, S04, ARG1, 8B, Fercal.

We also imported clones of the following important winegrapes - often more than once: Semillon, Sauvignon Blanc, Traminer, Chenin Blanc, Chardonnay, Cabernet Franc, Merlot, Pinot Noir, Muscat Ottonel, Gamay Noir (from Oregon!), Petite Verdot, Mueller Thurgau. We have also imported varieties which may find use in New Zealand, for example: Rabose Piave, Rkazitelli, Canada Muscat, Pinotage.

We regard importation as probably the quickest and most effective means of vine improvement, and value highly our overseas contacts who facilitate this process. In particular, we try and locate sources who are competent in virus indexing and have undertaken clonal evaluation studies.

Distribution
We have a multi-facet approach to locating high health, correctly named and genetically superior planting material. However, it is equally as important to develop a distribution system which facilitates and encourages the use of this material. In 1983, we established the New Zealand Vine Improvement Committee, which is modelled on the most successful self-help system developed in South Australia. Each region has its own committee which is responsible for establishing source blocks of improved material and distributing buds from them. In the future, we intend to develop a certification programme whereby the results of virus testing are given on each cutting bundle label. In 1983, when supplies of improved planting material were limited, we encouraged the groups to undertake positive and negative mass selection in commercial vineyards, but now improved planting material is being bulked up.

Variety evaluation
Up until recently, we have not given variety evaluation a high priority, as we considered that the future of the New Zealand industry depended upon improved clones of classic varieties. Recently, however, we have been encouraged to look at low cost bulk grape production, and disease tolerant varieties amenable to minimal pruning will be evaluated.

Our variety evaluation programme was initiated in 1983, and consists of three stages: Stage 1 evaluation is carried out at Te Kauwhata, with six vines grafted to S04. Promising varieties are then evaluated in

each of the grapegrowing regions, using several rootstocks in Stage 2 evaluation. Stage 3 evaluation requires larger plantings to permit commercial scale wine evaluation. If a variety shows particular potential, it is immediately put into Stage 2 evaluations upon release from quarantine.

We similarly have a number of rootstock evaluation trials in progress, encompassing all regions. We are continually initiating new trials as rootstocks are imported. We will rely on pilot trials in each region to overcome the problems of different soil types present. In several instances, we have added phylloxera to the trials where it was not known to be present.

CONCLUSION

Although our scheme is in its infancy, we have already made significant progress, so that within a few years, growers will be able to use only high health planting material. The key components of our vine improvement research are:

- Development of a variety register and accession number system;
- Search for old introductions;
- Verify variety naming;
- Comprehensively virus test, and where necessary, eliminate;
- Establish a Foundation Vineyard;
- Undertake clonal selection and evaluation;
- Undertake rootstock and scion variety evaluation;
- Develop a comprehensive importation programme;
- Develop an equitable distribution system.

I hope that this survey of our vine improvement activities may be of some use to the Oregon industry. I do know that you are well down the track in terms of importation and clonal evaluation, and I hope we can exchange information between our programmes. One important point to be learned from the New Zealand experience is that of not waiting until you have a phylloxera problem before undertaking rootstock importation and evaluation!

I would like to conclude with special mention of issues which seem to need consideration in Oregon. In general, your vineyards are less infected with virus disease than are those of New Zealand - no doubt due to the fact that Oregon has mostly used planting material out of the University of California virus-free programme. However, you should be cautious as we now know that some of the early releases from that programme are infected. Also, early indexing did not cover Rupestris Stem Pitting. Therefore, you may need to consider re-indexing your sources.

One question frequently asked in Oregon as well as New Zealand relates to the practical importance of grapevine virus diseases. Our approach is to 'plant the best material available' at the time. If we wait for virus-free material, we could wait forever. Also, some virus diseases are more important than others. We regard 'leaf roll', 'fanleaf' and 'corky bark' as the most important virus diseases to avoid, and perhaps in the future 'Rupestris Stem Pitting' may be included. However, for the moment, we do not regard 'fleck' and some other viruses to be so important. Recent advances in detecting virus diseases using serological techniques detects virus disease in what was considered to be clean material. This can be most frustrating.

The key argument here is that of performance testing. I believe there can be no alternative to clonal evaluation, to determine the best performer, irrespective of whether that might be for reasons of genetic superiority or virus disease freedom. However, you need to ensure that once a high performance clone is

established, avoid grafting it to a virus infected rootstock! From this point of view, I believe that quarantine services around the world need to be revised. Often they prohibit entry of material which is known to be of high performance elsewhere for the sake of not introducing a virus which is already present. How we will fare in that argument with quarantine authorities remains to be seen. On the other hand, we need to recognise that performance may well be improved with virus elimination.

I would also like to make a few comments on ampelography. Problems of variety naming are the easiest to overlook because generally you don't find them unless you have a skilled person searching for them. Why don't you encourage a graduate student to work in this area, as we have done (a knowledge of French is essential!); or, why not take advantage of the skills existing in the US for a survey of your plantings? Lucy Morton, who translated Galet's ampelography work, lives in Virginia - her skills and experience seem to be overlooked.