Improved Vine Material - Its Role in Vineyard Profitability

Is it worth risking potential returns from a vineyard, with a life of 25-35 years, for a saving of 1-2% on establishment costs?

RICHARD HAMILTON
Primary Industries, South Australia

Australians viticulturists have no excuse for using anything other than improved vine propagation material, particularly as the industry improvement groups are developing a national accreditation scheme. Cost is not a major factor, as it should be immediately obvious that the use of inferior propagation material offers only marginal savings, as compared to improved material (see Table 1). What may not be as obvious to all grapegrowers are the procedures which are required to supply improved vine material. This paper aims to provide this information.

What is improved vine propagation material?
Improved vine propagation material is a term used for cuttings which have originated from mother vines with known horticultural performance and health status which may be certified as to:

- true variety
- genetic uniformity
- freedom from known pathogens.

Accreditation of improved material is currently being reviewed, under the stewardship of the Wine and Brandy Producer’s Association of South Australia (WBPASA). Three working groups have developed documents describing major steps in the certification process relating to:

- quarantine and hygiene procedures
- vine improvement
- nursery practices.

Trueness to variety
Certification as trueness to variety is an assurance that every vine performs at its true genetic potential. In order to maximize vineyard returns it is critical that all material is closely matched by the Food and Agriculture Organisation and the International Board for Plant Genetic Resources (FAO/IBPGR). Technical guidelines for the safe movement of grapevine germplasm. These include:

- All material should undergo standardized indexing (and therapy) procedures.
- Under no circumstances should germplasm be moved as rootstock plant material.
- When available, accessions or cultivars should be obtained from a pathogen-tested collection. Otherwise material should be obtained from the lowest risk area possible.
- All material should undergo standardized indexing (and therapy) procedures.
- All quarantine entries are subjected to methyl bromide (pesticide) and hot water treatment prior to release to government post-entry quarantine stations. In recognition of quarantine standards in some overseas countries, there are currently two accredited sources for virus-tested grapevines.

Freedom from known pathogens
Austalian quarantine procedures have provided horticulturists with unique production opportunities, as many of the debilitating diseases present overseas have been prevented from entering Australia, or have been confined to defined areas (e.g. phylloxera and fanleaf virus). Movement of grapevine material into Australia is restricted by Commonwealth law. The regulations for legal entry of material are closely matched by the Food and Agriculture Organisation and the International Board for Plant Genetic Resources (FAO/IBPGR). Technical guidelines for the safe movement of grapevine germplasm. These include:

- Under no circumstances should germplasm be moved as rootstock plant material.
- When available, accessions or cultivars should be obtained from a pathogen-tested collection. Otherwise material should be obtained from the lowest risk area possible.
- All material should undergo standardized indexing (and therapy) procedures.
- All quarantine entries are subjected to methyl bromide (pesticide) and hot water treatment prior to release to government post-entry quarantine stations. In recognition of quarantine standards in some overseas countries, there are currently two accredited sources for virus-tested grapevines.

Cost of propagation material

<table>
<thead>
<tr>
<th>Vines per hectare</th>
<th>Own-rooted vines</th>
<th>Grafted vines</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vines per hectare</td>
<td>3,000</td>
<td>1,150</td>
</tr>
<tr>
<td>Cost of propagation material</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vinifera cuttings ($0.17)</td>
<td>$510 (1.0%)</td>
<td>$287.50 (1.1%)</td>
</tr>
<tr>
<td>Benchgraft scion ($0.25)</td>
<td></td>
<td>$322 (1.3%)</td>
</tr>
<tr>
<td>Benchgraft stock ($0.28)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cost of planting material</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vinifera rootling ($0.65)</td>
<td>$1,350 (3.9%)</td>
<td>$4,025 (16%)</td>
</tr>
<tr>
<td>Grafted rootling ($3.50)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total establishment cost per ha</td>
<td>$50,000</td>
<td>$25,000</td>
</tr>
</tbody>
</table>
Table 2 Quarantinable diseases and pests

<table>
<thead>
<tr>
<th>Virus and virus-like diseases</th>
<th>Fungal diseases</th>
<th>Insect pests</th>
<th>Nematode pests</th>
</tr>
</thead>
<tbody>
<tr>
<td>Corky bark</td>
<td>Black rot <strong>G. ulgeria biowelli</strong></td>
<td>Grape phylloxera</td>
<td>Dagger nematode <strong>Xiphinema index</strong></td>
</tr>
<tr>
<td>Ajinashika's disease</td>
<td>Rottnembrer <strong>Pseudopezicula trachiiolia</strong></td>
<td>Pseudococcus <strong>spp.</strong></td>
<td></td>
</tr>
<tr>
<td>Nepoviruses (grapevine fanleaf, tomato ringspot, Arabis mosaic, grapevine chrome mosaic, Joannes-Seyve virus, grapevine Bulgarian latent virus)</td>
<td>A neglected leaf spot <strong>M. yosohaearella angulata</strong></td>
<td>Mealybugs <strong>Eulecanium pruinosum</strong></td>
<td></td>
</tr>
<tr>
<td>Bacterial disease</td>
<td>Rust <strong>Physopella ampeosiosis</strong></td>
<td><strong>Daktulosphaira vitifolia (WA only)</strong></td>
<td></td>
</tr>
<tr>
<td>Bacterial necrosis</td>
<td>A neglected leaf scorch <strong>Pseudopezicula tetraspora</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pierce's disease</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mycoplasma disease</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Flavescence doree</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The following pests and diseases are quarantinable under State legislation:

Downy mildew **Plasmopora viticola** (WA only)

Insect pests

Grape phylloxera **Daktulosphaira vitifolia**

Nematode pests

Dagger nematode **Xiphinema index**

Foundation Plant Materials Service (FPM S), UCD, Davis, California, United States.

Saanichton Plant Quarantine Station, Agriculture Canada, Sidney, British Columbia, Canada.

Imports from accredited sources require 12 months growth in post-entry quarantine with general disease screening. Imports from non-accredited sources require 3 years disease indexing for quarantinable ‘virus’ diseases over a 3 year period, i.e. nepoviruses and corky bark (Ajinashika’s disease for material from Japan).

As A.Italia is a signatory to the International Plant Protection Convention (IPPC) it uses the definition of a quarantinable disease/pest as follows:

A quarantinable disease/pest is a disease/pest of potential economic importance to the country endangered thereby and not yet present there or present but not yet widely distributed and being actively controlled.

For a list of diseases described as quarantinable under Commonwealth legislation, see Table 2. Following a review (1999) initiated by the Bureau of Rural Resources (BRR), the current list of quarantinable diseases was agreed to in September 1991. The BRR report assessed some diseases (e.g. stem pitting, legno riccio, leafroll, vein mosaic, yellow speckle and vein necrosis) as non-quarantinable on the basis that they were either already present in Australia, or that they did not fall into the interpretation of a quarantinable disease (see Table 3 for diseases which are non-quarantinable but which are important for prevention through nursery hygiene).

Table 3. N on-quarantinable pests and diseases of importance for nursery hygiene

<table>
<thead>
<tr>
<th>Virus and virus-like diseases</th>
<th>Fungal Diseases</th>
<th>Insect pests</th>
<th>Nematodes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stem pitting</td>
<td>Armillaria root rot</td>
<td>Root knot nematodes</td>
<td>Mealybugs</td>
</tr>
<tr>
<td>Rupose wood complex</td>
<td>Black root rot</td>
<td>Meloidogyne javanica</td>
<td>Pseudococcus <strong>spp.</strong></td>
</tr>
<tr>
<td>Asteroid mosaic</td>
<td>Fusarium root rot</td>
<td>M. incognita, M. arenaria</td>
<td></td>
</tr>
<tr>
<td>Bratislava mosaic</td>
<td>Phytophthora root rot</td>
<td>Citrus nematode</td>
<td></td>
</tr>
<tr>
<td>Leafroll</td>
<td>Pythium crown rot</td>
<td>T. yielanclus semipenetrans</td>
<td></td>
</tr>
<tr>
<td>Fleck</td>
<td>Sclerotium crown rot</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vein mildew</td>
<td>Verticillium wilt</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vein Necrosis</td>
<td>Powdery mildew</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Botrytis rot</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Bacterial disease

Crown gall **Agrobacterium vitis**

Nematodes

Root knot nematodes **Meloidogyne javanica**, M. incognita, M. arenaria

Citrus nematode **T. yielanclus semipenetrans**

Insects

Frosted scale **Eulecanium pruinosum**

Mealybugs **Pseudococcus longispinus**, **Pseudococcus **spp.**

Origins of improved vine material

There are a number of programs run by government agencies around Australia, in collaboration with industry groups, which have provided sources of new material. These include:

- local selections from old plantings which have proven performance in both yield and quality;
- imported material from overseas programs;
- selections from breeding programs;
- material which has had its pathogen content modified.

The local evaluation programs and importation through quarantine have provided the majority of material with commercial potential. Prior to recommendation of this new material for distribution, it is generally evaluated in replicated trials to establish performance characteristics. Based on both yield and, more recently, wine quality measures, new varieties and clones are made available for distribution, generally through vine improvement organizations.

Distribution of improved vine material

A network of vine improvement organizations exists in Australia with national co-ordination through the Australian Vine Improvement Association (AVIA). AVIA was the first Australian industry-based horticultural improvement organization to be incorporated (1988). It did so in recognition of the need to reduce duplication of effort and to co-ordinate vine improvement efforts nationally.

The main objectives for AVIA include:

- material which has had its pathogen content modified.
- local selections from old plantings which have proven performance in both yield and quality.
- imported material from overseas programs.
- selections from breeding programs.
- material which has had its pathogen content modified.

The local evaluation programs and importation through quarantine have provided the majority of material with commercial potential. Prior to recommendation of this new material for distribution, it is generally evaluated in replicated trials to establish performance characteristics. Based on both yield and, more recently, wine quality measures, new varieties and clones are made available for distribution, generally through vine improvement organizations.
To promote the development of the Australian viticultural industries by coordinating grapevine improvement activities throughout Australia.

To recommend to the Grape and Wine Research and Development Corporation, the Dried Fruits Research Council and other appropriate bodies on grapevine improvement research in Australia.

To negotiate and enter into agreements with grapevine breeders for the appointment of the association as head licensee for the production and marketing of grapevine varieties in Australia.

To facilitate the equitable distribution of high quality propagation material of grapevine varieties and rootstocks to all production areas in Australia.

One of the keys to AVIA's success is that it is an organization that provides a focus and overview function; it is the regional groups which provide the mechanism for collection, packaging and distribution of propagation material (for details of regional improvement organizations see Table 4). Regional groups have the responsibility for planning, establishing and maintaining mothervine blocks. This requires considerable, not only of current demand, but also attempting to predict industry demands in 3 to 5 years time, as it takes this time for mothervine blocks to come into production.

The 1993 cutting season has seen demand way in excess of supply, which has presented grape improvement organizations with the difficult task of sourcing propagation material from 'best available' sources. This requires consideration of the need to provide assurance, not only of trueness to variety and genetic uniformity (through use of second generation cuttings from blocks established from material directly sourced from mothervine blocks), but also some certainty regarding their pathogen content.

Summary
This paper has described the advantages of using improved vine material for propagation of vineyards. Certified material is supplied with assurance, based on standard procedures that the material has a pedigree. This pedigree covers three categories:

- Trueness to variety — critical for wine labelling purposes.
- Genetic uniformity — for consistent vine performance in a given vineyard situation.
- Pathogen testing — to minimize the possibility that debilitating agents affect vine performance.

The cost for propagation material is relatively minor. Its importance is often overlooked, with concentration of effort more on the design and specifications of the more expensive items, such as irrigation and trellising. If there was no difference in the quality of improved material, as compared to any other material, this would not be a problem. However, as this paper has indicated, not all propagation material will produce consistent results and, in some cases, will leave a grapegrower with significant problems, particularly with yield potential and with problems with trueness to variety. No matter how well irrigated and trellised a vineyard is, it cannot realise its maximum potential unless it has been planted with vines propagated from certified propagation material.

Although the additional cost is negligible, improved vine material provides many extra benefits. Material supplied through vine improvement organizations provides funding, through levies, for co-ordination of vine improvement activities. Examples of this include research on new varieties, clones and rootstocks, and the provision of services which help towards securing the future for grapegrowers in Australia.

One of these services is that of support for the development of a national accreditation system for vine improvement. Accreditation is attempting to develop a process where a grower will have assurance that an order placed for propagation material, either as cuttings or as rootlings/graftlings, will result in a product which satisfies a standard that ensures maximum returns in future vineyard operations.

Given that accreditation is close to being established nationally, then the decision to plant with anything other than improved vine material begs the question, is it worth risking potential returns from a vineyard, with a life of 25–35 years, for a saving of 1–2% on establishment costs?