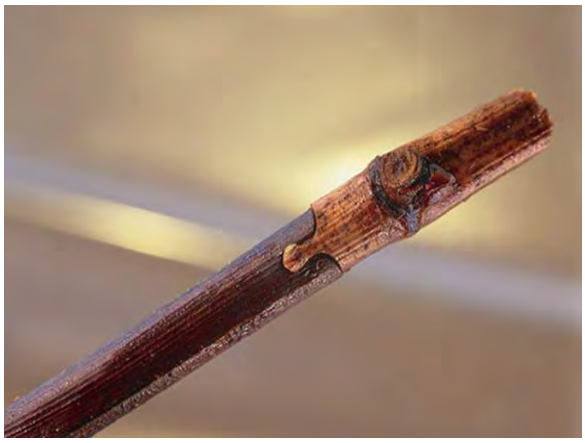

Proceedings of the 2nd National Rootstock Forum

State Government Victoria Department of Primary Industries

NATIONAL Wine&Grape Industry CENTRE

Yalumba Nursery
vines for the times

VINA
vine industry nursery association

CSIRO

Phylloxera and Grape Industry Board of South Australia

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Forum organising committee (from left) Paul Wright (VINA) Catherine Cox (PGIBSA) Nigel Blieschke (Yalumba Nurseries) Peter Hackworth (PGIBSA) Duncan Farquhar (NWGIC) Peter Clingeleffer (CSIRO) Absent: Rob Walker (CSIRO)

The organisers gratefully acknowledge the financial support of the Grape and Wine Research and Development Corporation and the assistance of the Victorian Department of Primary Industries, Irymple for the use of their facilities.

Executive Summary

The second national rootstock forum was held on May 21-22 at Irymple, Victoria.

68 researchers, grapegrowers, winemakers and other industry people attended the forum to:

- Review current research on rootstocks;
- Establish priorities for future research; and
- Establish a mechanism for national coordination.

The forum was a collaborative effort of:

- Phylloxera & Grape Industry Board of South Australia
- CSIRO
- Yalumba Nursery
- National Wine and Grape Industry Centre
- Vine Industry Nursery Association

As in the rest of the viticultural world, rootstocks in Australia were initially selected for their resistance to phylloxera. The variation in characteristics of rootstock hybrids also meant that they could be a tool to manipulate grape production; yield, water use, pest resistance, salinity and harvest .

In contemporary viticulture, drought tolerance and salinity have become the major drivers for the increased adoption of rootstocks and this is likely to increase if irrigation water remains restricted and as climate change increases. The majority of winegrapes in Australia are grown in warm inland areas, and are reliant entirely on irrigation water from the Murray Darling river system. While a high percentage of white varieties in these regions are grafted, sustainable production of red varieties is likely to trigger a major replant program with vines grafted to drought-resistant rootstocks. Rootstock use is much lower in cool climate regions which are also likely to come under pressure for reduced irrigation. The main water efficient rootstocks in Australia are R140, P1103 and Ramsey. Little work has been undertaken to measure their suitability in cool climates and on higher fertile soils.

While the impact of changing climatic conditions is the principal driver for change, phylloxera and nematodes are nonetheless seen as key components of rootstock selection. Phylloxera continues to spread in Australia while nematode resistance is re-emerging as an issue. In California nematode resistance is the primary consideration in breeding programs.

Research Priorities

The forum sought to address the following question:

> *"In relation to the use of rootstocks in the Australian wine industry, what additional Research, Development and Extension activities are required to benefit the industry in the future"?*

The participants identified six priorities:

National Co-Ordination

- A national framework for rootstock co-ordination
- Standardisation of trials
- Integration into an existing or future national structure
- Incorporating a national register of vines
- Requires a suitable funding model

Improved Information

- Dissemination is essential to change attitudes and promote adoption
- Need a model for integrated extension
- Research to Practice unit
- Information on rootstock-scion interaction is not widely available
- Need a cost-benefit analysis, rootstocks vs own roots

Industry Standards

- Need a national standard for clean planting material
- Nursery practices need to improve to reduce costs
- Rapid propagation R & D to aid distribution to the industry

Regional trials

- Require multiple regional trials, standardised and coordinated by a central body
- Focus on water use efficiency, salt, rootstock/scion interactions

Rootstock improvement

- Need to ensure long-term competitiveness – other countries all have breeding programs
- Need to recognise the need for a 'breeding continuum', ie cycle of breeding, evaluation and extension to industry
- Markers for key traits
- Maintain research capacity for phylloxera, nematodes, water salinity etc

Rootstock Physiology

- More fundamental research required
- Priority focus is water and salinity (including response to climate change)
- Graft union compatibility also needs better understanding

Cooperation, Coordination and Extension

The meeting expressed strong support for a national, integrated approach to rootstock research and extension and that a new national structure was required that encompassed standardisation of trials, the establishment of a national register for vineyards, rootstocks and germplasm.

The meeting agreed that progressing this was largely the responsibility of the existing national organisations, the Winemakers Federation of Australia, Winegrape Growers Australia, Grape and Wine Research and Development Corporation and the National Vine Health Steering Committee. It could be linked to a future national vine improvement group.

It was agreed that the forum organising committee would progress the outcome of the forum with the national bodies.

CSIRO Merbein

Finally, the forum unanimously expressed its support for CSIRO Merbein. The forum is concerned to ensure that wine and grapegrowing research programs are not compromised and that the national germplasm is maintained.

Introduction

In 2005, 16 researchers from the wine and grapegrowing industry attended the first national rootstock research forum, in Irymple, Victoria.

In 2008 the second national rootstock research forum was held in Irymple, Victoria. It was initiated in response to growing interest in the use of rootstocks and the recognition of the need for greater cooperation in research and extension.

68 participants[1] from the wine and grape growing industries attended the two day forum with the main focus to:

1. Review current research on rootstocks;
2. Establish priorities for future research; and
3. Establish a mechanism for national coordination.

The forum was a collaborative effort of the following organisations:

- Phylloxera & Grape Industry Board of South Australia
- CSIRO
- Yalumba Nursery
- National Wine and Grape Industry Centre
- Vine Industry Nursery Association

[1] See appendix 1 for a list of attendees

Session One: Rootstocks in Context

Convenor: Peter Hackworth, Phylloxera and Grape Industry Board

Peter Hackworth thanked those present for attending. He explained that the first forum held 2 years earlier had been attended by 16 people with the focus on research. With the second forum, the agenda had expanded to include setting priorities for research and extension and identifying the best structure for advancing national cooperation.

He reminded the audience that the forum was a national initiative; the organising committee members were he and Catherine Cox (Phylloxera and Grape Industry Board of SA), Rob Walker and Peter Clingeleffer (CSIRO), Nigel Blieschke (Yalumba), Duncan Farquhar (National Wine and Grape Industry Centre) and Paul Wright (Vine Industry Nursery Association).

Industry Perspectives

This session aimed to capture the industry perspectives on rootstocks – how rootstocks fit into the wine industry and how the wine industry affects the uptake of rootstocks. To summarise this, nursery manager for VINA Paul Wright and Constellation wines Stonehaven Wrattonbully vineyard manager Peter Bird, were asked for their comments.

Vine Nursery Perspective: Paul Wright VINA

Climate change, drought and insufficient irrigation water supplies are upon us now, and are likely to challenge us into the medium to long term viticultural future.

The majority of grapes in Australia are grown in warm inland areas, and are reliant entirely on irrigation water from the Murray Darling river system.

When growers were asked in 2000 what their criteria was for choosing a rootstock they would invariably say, 'nematodes, salt, vigour, drought, and phylloxera', in that order. Ask them today and their focus is squarely on water efficiency first and then they consider other attributes.

As growers are starting to replace existing vineyards with grafted vines, the grape growing industry needs to focus research on how to better manage water efficient rootstocks in these areas, in fact, all areas. Some new rootstocks have been released from Australian breeding programs, but details of trials and winemaking attributes are not widely known and plant distribution is severely restricted.

Until now cool climate areas have been irrigated from underground supplies and thus insulated from water restrictions. Government departments are now warning that it is only a matter of time before the widespread capping and monitoring of artesian water assets, accompanied by water restrictions similar to those imposed on inland water systems such as the Murray Darling. This will generate a call for a range of cool climate

water efficient rootstocks. At present there are no suitable rootstocks with these qualities. Research needs to focus on this fundamental requirement. Emerging cool climate varieties such as 3309C and 420A will ultimately not satisfy grower demands when restrictions kick in.

In the various regions of cool climate fertile soils, different circumstances and management structures need to be identified and specific trials set up with the over riding objective: – quality grapes with significant water savings without loss of yield. There are no rootstocks presently in Australia (or overseas that I can identify) which will completely satisfy this criteria, and a breeding program initiated now will take a decade or more to produce something suitable. We need to start using rootstocks now in common use.

The main water efficient rootstocks in Australia are R140, P1103 and Ramsey, suited mostly for warm inland regions and all are vigorous. How do we better manage these rootstocks in cool climates and fertile soils?

In addition to statistically structured replicated trials there needs to be trials that growers can directly relate to. Note that there are many grower associations that have money for trial work and most can attract additional funding. Growers relate to whole of block or whole of row, single graft combination trial plantings in their own regions.

In order to manage plant vigour, trials can include:

- increased planting densities equivalent to 2000, 4000, 6000 vines/Ha
- Reduced water inputs (an objective in itself)
- Withdrawal, or reduction, of nutrient applications
- Cover cropping
- Specific canopy management

Then make wine from the trial plots and involve growers with comparative assessments. After all, it is growers who ultimately will need to be convinced to increase the use of rootstocks.

It would be desirable to have an overarching body to co-ordinate trials on a national basis. This body should have the skills to assist local trial managers with standardised trial data, and to be able to analyse and disseminate results to industry.

It must be noted that nurserymen are advised to not act as "experts" when it comes to answering grower questions about which varieties and rootstocks to plant. Litigation hangs heavily over anyone who does.

Choice of rootstock is generally referred back to the purchaser of their grapes and their winery liaison officers or departmental advisors. In many cases it is the winemaker who makes the decision as to which rootstock to use, or whether to use a rootstock at all. Irrespective, there is a huge lack of definitive knowledge out there that should be addressed by a comprehensive education program based on regional trial work.

On a more practical note for the nursery industry, the percentage takes of first grade rootlings across all graft combinations during 06/07 was down significantly over the previous year. This drop is believed to be a result of poorer quality cuttings of both rootstock and vinifera due to drought borne difficulties in propagation source blocks management.

There needs to be developed a standardised rapid assessment of cutting wood quality for nurseries to be confident the material they purchase will give an economic output. Nurseries cannot afford to continue to suffer the losses experienced in recent times.

Also, there is little understanding of graft incompatibility, or lack of affinity, with a large number of rootstock commonly used in Australia. Similar reports are widespread internationally. Are there varying levels of incompatibility, what causes it, is it a natural phenomenon, are there pathogens at play or is it just poor quality wood?

In order to maximise the use of rootstocks these questions are certainly worth answering.

Winegrape Grower Perspective: Peter Bird Constellation Wines, Wrattonbully

Viticulture is variable and highly influenced by environment including challenges associated with drought, frost and rain. The wine industry constantly faces over supply and inconsistent monetary returns. The current viticultural climate has proved that grapegrowers are resilient to the variable effects associated with growing grapes and are consistently improving and updating approaches to viticulture. Grapegrowers are tough buggers.

The Australian wine industry possesses knowledge relating to families of rootstocks and their suitability for grafting and or site selection. However the rootstock adoption rate is low with the amount of plantings widely contained to PIZ (with the exception of Sunraysia and the Riverland).

With the increased climatic variability, rootstocks can offer a solution to a lot of today's current viticultural issues and with more attitudes changing towards rootstocks- particularly those attitudes of winemakers, it is an opportunity to implement a steady routine of replanting, spreading the cost and risk whilst ensuring the industry becomes more efficient, improves its quality and competitiveness.

Remember, of the world's great vines, how many of them were grown on own-roots?

Session Two: Environment and Management

Convenor: Assoc. Prof. Dr Peter Dry, Adelaide University

Performance of Cabernet Sauvignon vines on Ramsey rootstock under reduced irrigation.

Brian Loveys[1], Robert Strachan[2], Ashley Ratcliff[2], Ashley Wheaton[3] and Hamlyn Jones[4]

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[2]Yalumba Wines, PO Box 10, Angaston, SA 5353

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[4]University of Dundee at SCRI, Division of Environmental and Applied Biology, Dundee DD2 5DA, Scotland

An experiment was established in the South Australian Riverland at Waikerie where 5 levels of irrigation were applied to Cabernet Sauvignon vines on Ramsey rootstock. The experiment was designed to assess the response of the vines to reduced irrigation over a number of seasons and their subsequent recovery. It has also been used to develop methods for the measurement of stomatal conductance using infrared thermometry. Each treatment was applied to 5 adjacent rows of 68 vines. Measurements were made on the centre row of each treatment. Irrigation water was supplied at seasonal rates equivalent to 6.7, 3.3, 2.3, 1.7 and 0.6 ML/ha. Vine performance was assessed throughout the season by measurement of leaf gas exchange and at harvest by crop yield and quality. All vines, including those receiving minimal water, performed reasonably well, although average stomatal conductance and yield fell as water was reduced. Measurements of chloride in petioles, fruit, and wine suggested that the vines were able to access saline ground water to survive. The role of the rootstock in facilitating this will be discussed.

Rootstock effects on vine partitioning under varied water supply

Bruno Holzapfel & Jason Smith

National Wine and Grape Industry Centre, PO Box 588, Wagga Wagga NSW 2678, Australia

Rootstocks are known to have an influence on the vegetative growth and yield of the scion, and also can influence fruit quality in grafted vines with direct effects on the uptake of ions, or more indirectly by affecting the balance between fruit and shoot growth. The adaptability of rootstocks to restrictive soil conditions, water and nutrient supply is variable. These impacts on vine performance of the different rootstock varieties on the scion can become important selection criteria when deciding which rootstock is best for certain situations.

A three-year study was undertaken with pot-grown *Vitis vinifera* L. cv. Shiraz on six rootstocks (Ramsey, 140 Ruggeri, Schwarzmann, 5BB Kober, and 101-14 and 420A Millardet et de Grasset) to study the effect of grafting and water stress on whole vine growth and reproductive development. Annual biomass accumulation of the root system and shoot was determined non-destructively for the first and second full season after grafting, where vines were grown without (non-fruiting) and with fruit (fruiting) respectively. In the fruiting season, yield and associated yield components (fruitfulness, inflorescence flower numbers, fruit-set and berry weights) were also determined. At the end of the non-fruiting season, a significant rootstock effect on biomass distribution between the root system and shoot was observed. Graft combinations with a high shoot weight ratio (SWR) had higher relative yearly growth rates (RYGR) than those that partitioned a greater amount of total biomass to the roots. The high crop loads that subsequently developed on these vines were carried at the expense of vegetative growth and carbohydrate reserve accumulation. The allocation differences of starch reserves to the roots between rootstocks suggest an influence on root function. In addition, reduced irrigation favoured the biomass allocation to the shoots away from the roots, resulting in lower starch concentrations and amounts in these roots. This suggests a low priority for root growth and carbohydrate reserve allocation compared to the fruit under limited water supply.

The work indicates that rootstocks can have implications on biomass partitioning, by varying the allocation between roots and shoots in vegetative vines and then between the fruit and the rest of the vine. In addition, the differences of vine root reserves between rootstocks and alteration under different irrigation regimes could be an important issue for root dynamics, and consequentially water and nutrient uptake. Currently this is investigated, with the aim to further understand vine resource allocation on root dynamics and nutrient uptake as well as vine water relations. The outcomes of these studies will assist in optimising vine water and nutrient supply for enhancing grape production.

Rootstock effects on vine performance, conferred scion vigour, fruit and wine composition, and aspects of vine physiology relating to water use efficiency and drought tolerance.

Peter Clingeleffer

CSIRO Plant Industry, PMB, Merbein Victoria, 3505.

Grower adoption of rootstocks provides a tool to manipulate vine growth characteristics, production, berry and wine composition and quality attributes. Furthermore there is potential to use rootstocks to improve water use efficiency and drought tolerance. This presentation will discuss these issues with special reference to the issue of conferred vigour on scion performance, fruit composition and wine quality attributes. It will show that compared to standard rootstocks, the low to medium vigour rootstocks released by CSIRO have reduced levels of juice potassium, require lower levels of tartaric acid for pH adjustment in winemaking and have enhanced wine spectral properties. These new low to medium vigour rootstocks have potential to be components of an integrated approach for winegrape management using high density plantings with closer row spacings to increase yields per hectare, vineyard water use efficiency and sustainability. In addition, the paper will present results on root architecture, transpiration efficiency and drought tolerance and discuss the role that rootstocks may play in improved water use efficiency and drought tolerance.

Rootstocks for saline conditions

Rob Walker, Haijun Gong and Deidre Blackmore

CSIRO Plant Industry, PMB, Merbein, Vic. 3505

Previous research has shown that rootstocks that perform best in terms of yield performance under saline conditions have moderate to high innate vigour and moderate to high capacity for chloride and sodium exclusion. While grapevines generally accumulate more chloride relative to sodium, there are differences between varieties in their relative accumulation of the two ions. For example, while chloride was still the predominant ion accumulated, laminae of Shiraz during season 2006-2007 at Padthaway accumulated more sodium than laminae of Chardonnay and consequently exhibited a higher ratio of sodium to chloride for most of the rootstock types examined. We have also tracked yield performance of Chardonnay and Shiraz on own roots and various rootstocks under saline conditions over several years. Yield on rootstocks with moderate to high capacity for chloride exclusion has generally been sustained, whereas yield on rootstocks with poor capacity for chloride exclusion has shown significant deterioration. The chloride excluding rootstocks Ramsey, 1103 Paulsen, 140 Ruggeri, Schwarzmann and 101-14, each grafted with Chardonnay and Shiraz and grown under saline conditions at Padthaway, SA, are also being compared with Chardonnay and Shiraz on own roots with respect to wine composition and sensory quality. Results from the first year of a current 3 year trial will be shown and discussed.

Cabernet Sauvignon rootstock performance under three seasons of reduced irrigation; yield and irrigated water use index

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Reduced irrigation has been applied for three seasons to drip irrigated Cabernet Sauvignon vines grafted to Ramsey and 101-14 rootstocks at Yalumba's Oxford Landing Estates near Waikerie, South Australia. Total irrigation hours were the same for all vines. Irrigation treatments were applied using different dripper output rates to achieve 70% and 53% of the Control respectively, resulting in different irrigation depth proportional to dripper outputs. There were three replicates and the trial has been conducted over three irrigation seasons to date.

Yield and irrigated water use index (IWUI) differences between rootstocks were seasonally dependent. Reduced irrigation reduced yields and increased IWUI. The magnitudes of these IWUI differences were also seasonally dependent. Cabernet grafted to Ramsey showed a higher IWUI than 101-14 under 70% and 53% treatments. Berry characteristics were monitored at varying times within each season of the trial. Small lot wines were made in the first two seasons.

The relative drought tolerance of Ramsey and 101-14 rootstocks will be discussed.

Convenor's summary

- Current field-based rootstock research in Australia is limited.
- Many of the tools now available for assessment of rootstock performance were discussed in this session; for example, measurement of leaf temperature, rhizotrons, carbon isotope discrimination.
- Differences in root architecture may explain the differences in drought tolerance among rootstocks. Is this related to the rootstock effect on carbon partitioning and the fact that certain stocks appear to allocate more to the root system than others?
- Is graft compatibility related to the ratio of scion to stock girth?
- Many of the speakers described the good performance of Ramsey under conditions of reduced irrigation. This emphasises the importance of the interaction between rootstock type and irrigation management strategy.
- Wine production should be an integral component of rootstock assessment—if only to convince the winemakers that rootstock use will not necessarily have an untoward effect on grape end-use rating.
- High pruning weight (as a measure of "vigour") is associated with reduced wine quality as indicated by high wine K and pH. Is this a direct effect of rootstock on berry composition, or an indirect effect via canopy density? On the other hand, high "vigour" is best for salinity tolerance.
- The large degree of genetic variability within the rootstock population appears to offer potential for the breeding of drought tolerance.
- Although consumers appear to be reluctant to accept the use of GM scion varieties, would the same apply to GM rootstocks?

Session Three: Rootstock Improvement

Convenor: Peter Scholefield, Scholefield Robinson Horticultural Services

Rootstock breeding and development for Australian wine grapes

Peter Clingeleffer[1], Tim Jones[2], Steve Sykes[1] and Rob Walker[1]

[1]CSIRO Plant Industry, PMB, Merbein, Victoria, 3505.

[2]Present address: Yalumba Nursery, PO Box 10, Angaston, South Australia

Problems associated with adoption of high vigour rootstocks by the wine industry include negative impacts on berry composition associated with high potassium uptake, high grape juice pH, poor organic acid composition, a requirement for high levels of acid addition for pH adjustment during winemaking and reduced colour of wine. There is an ongoing need for new rootstocks with characteristics that enhance water use efficiency and drought tolerance. Studies to develop new rootstocks, meeting key selection criteria with respect to nematode and phylloxera tolerance, vine vigour (ungrafted and conferred), propagation characteristics and mineral element discrimination will be reported. We have been able to demonstrate that the effect of rootstock genotype on grafted vine vigour, yield and berry weight is highly heritable. This indicates a high potential for selective breeding of rootstock varieties to combine and amplify beneficial traits that can be conferred to commercial wine grapes. Application of Best Linear Unbiased Predictions (BLUP), which takes into account the effects of row, vine, plot, vine replacement, repeated measures and spatial correlations, has enabled us to predict how much a particular rootstock genotype affects the performance of the vine, having taken into account other environmental factors that may affect the traits of interest. Approaches to integrate screening techniques for transpiration efficiency, drought tolerance and root architecture will be presented. Options for development of improved screening procedures will also be discussed. The studies include assessment and screening of material at all stages of development within the breeding pipeline. These include ungrafted populations of rootstock hybrids, new rootstock genotypes identified for further evaluation as grafted vines and identification of new rootstock genotypes for commercial release.

Development of sustainable phylloxera resistant rootstock recommendations for Australian conditions based on triphasic screening using genetically distinct clonal lineages of Daktulosphaira vitifoliae

Kevin S. Powell, Ginger A. Korosi and Carolyn J. Trethowan

Department of Primary Industries, Biosciences Research Division, Rutherglen Centre, Victoria 3685, Australia

Screening for resistance or tolerance to grapevine phylloxera *Daktulosphaira vitifoliae* Fitch has generally focused on selecting populations of insects and not the use of genetically distinct clonal lineages. It has also focused on the use of only one protocol; laboratory or glasshouse or field screening.

In Australia the first systematic triphasic approach has now been developed to screen for phylloxera 'resistance' using up to six genetically distinct clonal lineages of grapevine phylloxera. Laboratory studies utilised an excised root bioassay protocol, glasshouse studies utilised a quarantine mesh system, to avoid cross contamination of phylloxera genetic strains and field studies are proposed using trapping techniques to monitor population abundance in commercial vineyards with natural infestations of grapevine phylloxera.

Screening of six genetic strains of phylloxera for resistance under glasshouse and laboratory to a range of commercially available rootstocks has shown that markedly different virulence levels are evident on both 'resistant' rootstocks and 'susceptible' *Vitis vinifera* L. Abundance of phylloxera on rootstocks under field conditions is influenced by rootstock and site conditions but requires further screening. Phylloxera abundance on rootstocks impacts on detection, quarantine and management. Ultimately, provided verification is conducted under field conditions, improved rootstock resistance ratings can be developed based on genotypic interactions under Australian conditions.

Recommendations from a 2008 review of grapevine nematology in Australia.

Greg E. Walker

SARDI Plant Research Centre, GPO BOX 397 Adelaide SA 5001.

A major review of grapevine nematology in Australia has recently been published (Walker and Stirling 2008) in conjunction with an international nematology congress; its recommendations include:

1. Nematode surveys of recently established viticulture regions.
2. Hygienic nursery production systems delivering quality-assured, nematode-free planting material.
3. Development of sampling protocols and rapid, DNA-based tests for all major nematode pests, and compilation of user-friendly information on damage thresholds, applicable to various climates and soils.
4. Strategies for overcoming replant problems.
5. A monitoring program for aggressive nematode populations.
6. Research on damage caused by nematodes other than Root-knot Nematode, particularly Ring and Root-lesion Nematodes, and on cultivar/rootstock resistance.
7. A nationally coordinated grapevine-breeding program to address issues including nematodes and Phylloxera, and cultivars/rootstocks with better, more durable resistance to a greater range of nematodes and soil-borne pathogens, and adapted for local use.
8. Research on improved chemicals and alternative strategies, as access to soil fumigants/nematicides becomes increasingly restricted.
9. Improved farming systems/agronomic practices using controlled traffic, reduced tillage, better irrigation scheduling and nutrient monitoring, and precision agriculture, resulting in improved soil health.
10. Research on suppression of nematodes and soil-borne pathogens through organic matter management, cover cropping, mulches and organic amendments.

Session Four: Rootstock Wines Tasting

Peter Clingeleffer (CSIRO) and Nigel Blieschke (Yalumba Wines) lead an informal tasting of wines made from rootstock trials.

Day one ended with an informal dinner at Trentham Estate Winery.

Session five: Priority Setting

Convenor: Dr Mark Krstic, GWRDC

Overseas rootstock breeding programs: an Australian perspective.

Peter Clingeleffer

CSIRO Plant Industry, PMB, Merbein, Victoria, 3505

Rootstock breeding is undertaken in major grape producing countries. Rootstock breeding programs located in Geisenheim in Germany, Montpellier and Bordeaux in France, Geneva and Davis in the USA were visited as part of a study tour in 2006. Information on the breeding activities at each institute, their relevance to the Australian industry and potential for collaborative research will be discussed.

Regional perspectives

Victoria: Michael Pullen (Victorian and Murray Valley Vine Improvement Assoc.)

Production and distribution of rootstock has varied dramatically over the past decade, with sales averaging in the area 2.5 million across 25 varieties: mainly Ramsey, Ruggeri, 1103 Paulsen, 101-14 and Dog Ridge, but including other varieties like Schwarzmann, Richter 99, 110 Richter, Harmony, 420 Millardet and 3309 Courderc. Varying range of quantities but all significant commercial plantings.

In the early-mid 90's, all grape industries were going through adjustment. Dried fruits industry was shrinking, wine industry was exploding and table grape industry was flourishing in Robinvale/Euston area. Demand was so high that cuttings, that today would be discarded, were being snapped up at any price.

VAMVVIA was servicing the needs of all three industries throughout Victoria and the Murray Valley region. Demand was such that VAMMVIA undertook an expansion program at the Dareton Research Station. In 2003, DPI Vic decided to sever its ties with vine improvement because it was a deemed a commercial activity - 25 years of R & D lost. DPI suggested we reproduce what we had at Irymple at the new Dareton site; 22 hectares or 13,500 mature plants!!

The Dareton site is now VAMVVIA's rootstock production site. Eight rootstock varieties are currently available: 1103 Paulsen, 775 Paulsen, Ramsey, 140 Ruggeri, 101-14, Dog Ridge, Freedom and Boerner. We have a capacity to take 1.5 million cuttings. Currently demand is mainly focused on Ramsey and 1103 Paulsen varieties.

The AVIA nuclear collection consists of 19 varieties, 4 vines of each variety. It is accessible to member vine improvement groups.

South Australia: Catherine Cox (Phylloxera and Grape Industry Board of South Australia)

Generally, rootstock use is low in South Australia, with the exception of the Riverland (40% on rootstocks) and Barossa Valley (20%). The remaining key regions have less than 10% of their planted vines on rootstocks.

- Adelaide hills 4.5%
- Clare Valley 3%
- Limestone coast (summed) 9%
- McLaren Vale 8%

Regional grape growing groups were consulted in preparing for this presentation and some common themes emerged on how rootstocks are perceived and used:

- Increased water pressure and drought have aided in rootstock uptake, particularly in whites and there is a lot more interest in the drought tolerant rootstocks such as Ramsey and 1103P.
- A number of regions interviewed mentioned a stronger commitment to rootstock trials and forward predicting of what varieties and rootstocks will be the future for the region.
- A greater emphasis is required into researching rootstock choice. Some regions are feeling the effect of choosing a devigorating rootstock 10 years ago for an environment with seemingly plentiful water available and now 10 years later are facing the consequences of choosing a rootstock that can not handle a drought induced environment.
- Of the seven regions surveyed, six indicated that the choice of rootstock is still a problem to growers. Information is acknowledged as being more readily available; however there is still a problem with accessing more practical based information including the management of rootstocks.
- Cost of rootstocks is still a problem.

In summary, the main uptake inhibitors in South Australia are which rootstocks to use and cost. However, in general, all regions have a strong and positive commitment to rootstocks. The current climatic environment has increased rootstock awareness particularly with regards to drought and salinity tolerant rootstocks however it is acknowledged that more information is required on choice, management and performance of rootstocks for South Australia.

Western Australia: Kristen Kennison, Department Of Agriculture and Food (presented by Catherine Cox)

Rootstock research for premium wine, dried fruit and table grape production in Western Australia (WA) has been conducted by the WA department of Agriculture and food since the 1950's. This research initially aimed to overcome reductions in yield, fruit quality and vine vigour due to nematode damage of vine roots. Rootstocks have been used by nearly all grapegrowers in the Swan Valley since 1975, and since this time, a range of rootstocks have been evaluated.

All vines in commercial table grape vineyards in WA are grown on rootstocks, irrespective of previous land use, whereas rootstocks for production of wine grapes in the South West of WA has historically been low. For production of table grapes, Ramsey producers the largest berry size and is the dominant rootstock used at Carnarvon, Walkaway, Swan Valley and on the coastal sands. Schwarzmann is the preferred rootstock in the cooler regions south of Perth. Freedom, 34EM, Foex and 99 Richter also have a role for specific environmental or soil conditions.

The low rate of rootstock adoption by wine grape growers in the South West has predominantly been due to the absence of nematodes in vineyards that were developed on virgin land coupled with a lack of rootstock research in WA. A rapid expansion of wine grape plantings in WA in the late 1980s also led to limited rootstock adoption for development cost savings.

The trend for rootstock use for wine production in South West of WA is changing as rootstocks are being increasingly used in replant situations due to the presence of nematodes. Furthermore, vignerons are seeing the benefit of rootstock use for vigour control. For these purposes, popular rootstocks include 1103 Paulsen, 5C Teleki, 140 Ruggeri and 110 Richter. Rootstock trials within the South West have also shown 34EM, Foex and 5C Teleki to have potential for premium wine grape production.

Rootstocks will be of future importance for wine production in WA for:

- Use in replant situations and/or where detrimental nematode species are present;
- To reduce negative effects associated with potential changes in climate (increase in temperature/climate change)
- For production of premium wine grapes (including vigour control); and
- Use in areas where drought and saline water are an issue.

Enhanced knowledge of rootstock performance in WA growing conditions is required together with extension of this information to vignerons. Current importation and evaluation of rootstocks in WA is aiming to provide additional options and recommendations for future wine grape rootstock use.

New South Wales: Emma Grabham (Murray Irrigators Incorporated)

The MIA is in a very different situation to other irrigated regions as it received almost all of its water allocation this vintage.

73% of grapevines in Griffith are planted on their own roots. 11.6% are grafted to Ramsey while les than 1% are grafted to 110 Richter, SO4, 101 -14, 5BB Kober, 5C Teleki, Dogridge, K51-40, 140 Ruggeri or Paulsen!

MIAVIS sold over 300,000 rootstock cuttings in 2007, but none were to other NSW areas.

Setting the Priorities

Following the regional presentations, participants were divided into 4 groups each with a facilitator. Groups had to address and prioritise the issues relating to the focus question:

"In relation to the use of rootstocks in the Australian wine industry, what additional Research, Development and Extension activities are required to benefit the industry in the future"?

After discussion, the group reconvened and results of the discussion were showed. In order of priority (as selected by industry participants) the issues were:

National Co-Ordination

- A national framework for rootstock co-ordination
- Standardisation of trials
- Integration into an existing or future national structure
- Incorporating a national register of vines
- Requires a suitable funding model

Improved Information

- Dissemination is essential to change attitudes and promote adoption
- Need a model for integrated extension
- Research to Practice unit
- Information on rootstock-scion interaction is not widely available
- Need a cost-benefit analysis, rootstocks vs own roots

Industry Standards

- Need a national standard for clean planting material
- Nursery practices need to improve to reduce costs
- Rapid propagation R & D to aid distribution to the industry

Regional trials

- Require multiple regional trials, standardised and coordinated by a central body
- Focus on water use efficiency, salt, rootstock/scion interactions

Rootstock improvement

- Need to ensure long-term competitiveness – other countries all have breeding programs
- Need to recognise the need for a 'breeding continuum', ie cycle of breeding, evaluation and extension to industry
- Markers for key traits
- Maintain research capacity for phylloxera, nematodes, water salinity etc

Rootstock Physiology

- More fundamental research required
- Priority focus is water and salinity (including response to climate change)
- Graft union compatibility also needs better understanding

Session Six: Co-ordination, Cooperation, Extension

Having identified priorities for future research, participants then discussed options for greater coordination and cooperation.

A model for the future: Vine Improvement and Rootstocks

Nigel Blieschke, Yalumba Wines

Current drivers for rootstock use:

- Nematode resistance
- Drought tolerance
- Salinity tolerance
- Phylloxera resistance
- Vigour manipulation
- Better earlier establishment
- More consistent yields

Future drivers:

- Climate Change leading to lower water availability & increasing salinity of irrigation water
- Potential spread of Phylloxera
- Increased replanting due to the need for varietal change

- Greater awareness of the benefits of rootstock use

Impediments to increased rootstock use:

- Negative perception of wine quality
- Lack of regionally specific rootstock performance data
- Inconsistency in trial methodology leading to confusion re rootstock performance & wine quality outcomes
- Limited industry funding for rootstock trial work
- A lack of rootstock cultivars suited to Australian conditions
- Rootstock work isn't integrated across research institutions and industry
- Cost

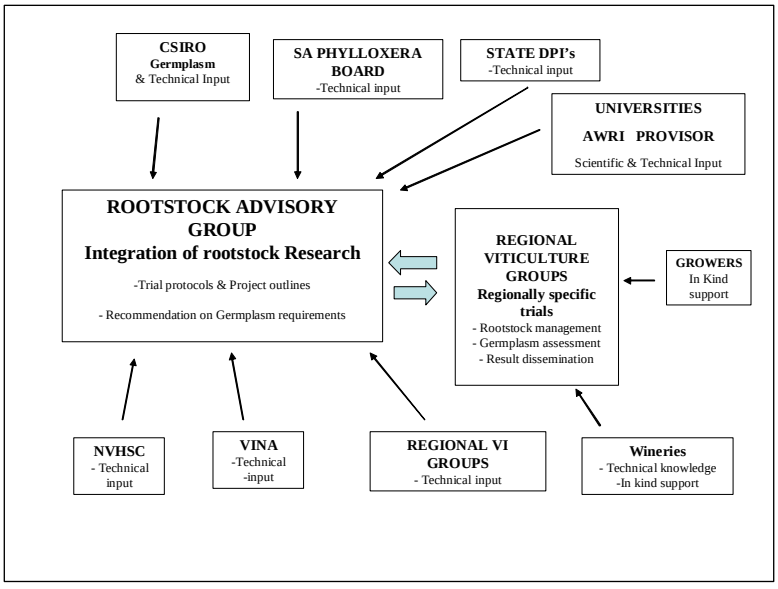
What do the stakeholders need?

- Grape growers & winemakers:
- Which stock is going to suit which region?
- How do I manage rootstocks to produce the appropriate quality?
- What benefits can I gain from using rootstocks?
- Researchers:
- To understand the physiology and genetic control of rootstock performance and rootstock scion interactions
- Scientifically valid data for interpretation and publication
- Ongoing funding for research

Benefits of an Integrated approach:

- Allows input from all stakeholders
- Identification of core issues leading to focused research
- Improved transfer of knowledge between stakeholders
- High efficiency in research outcomes due to synchronized research framework
- Improved sustainability & profitability

A model for the future: Vine Improvement and Rootstocks



Discussion

The meeting expressed strong support for a national, integrated approach to rootstock research and extension and agreed that a new national structure was required that encompassed standardisation of trials, the establishment of a national register for vineyards, rootstocks and germplasm.

A national approach will improve the dissemination of information, promote integrated extension and standardise trial establishment analysis and evaluation (enabling greater transfer of results from region to region). A national approach provides greater opportunity for securing funding for fundamental research into understanding the physiological differences between rootstock hybrids, including drought and pest resistance and for trials to improve rootstock selection and management.

The meeting agreed that progressing this was largely the responsibility of the existing national organisations, the Winemakers Federation of Australia, Winegrape Growers Australia, Grape and Wine Research and Development Corporation and the National Vine Health Steering Committee. It could be linked to a future national vine improvement group.

It was agreed that the forum organising committee would progress the outcome of the forum with the national bodies.

Finally the forum unanimously expressed its support for CSIRO Merbein. The forum is concerned to ensure that wine and grapegrowing research programs are not compromised and that the national germplasm is maintained.

Appendix One Forum Attendees

Catherine Anderson, Brown Brothers

Pedro Balda, CA Henschke

Peter Bird, Constellation Wines Australia

Nigel Blieschke, Yalumba Nurseries

Jason Cappello, Wine Grapes Marketing Board

Yasmin Chalmers, DPI Irymple

Mark Cleggett, Glenavon nurseries

Peter Clingeleffer, CSIRO

David Coleman, Adelaide Hills Vine Improvement

Travis Coomb, CA Henschke

Catherine Cox, Phylloxera and Grape Industry Board of South Australia

Doug Cox, Woodlea Nursery

Bryan Currie, Riverina Winemakers Ass'n

Scott Curtis, Ramco Wine Group

Hilary Davis, AVIA

Mark Deegenaars, Sirromet Wines

Peter Dry, University of Adelaide

Lee Duffy, E.E. Muir & Sons P/L

Marcel Essling, AWRI

Duncan Farquhar, Charles Sturt University

Andy Gordon, KC Nurseries

Emma Grabham, MIAVIS

Ray Guerin, Constellation Wines Australia

Peter Hackworth, Phylloxera and Grape Industry Board of South Australia

Richard Hamilton, Fosters Wine Estates

Fred Hancock, DPI Irymple

Prue Henschke, CA Henschke

Bruno Holzapfel, CSU

Graham Kaye, Stonehaven Padthaway Vineyard

Mark Krstic, GWRDC

Brian Loveys, CSIRO

Kym Ludvigsen, Taltarm Vineyards

Craig Markby, CA Henschke

Pascal Marty, Fosters wine Estates

Mike McCarthy, SARDI

Rachael McClintock, R & D Viticultural Services

Liz McGuire, Murray Valley Winegrowers Inc

John Messina, Sunraysia Nurseries

Wayne Mussared, CA Henschke & Co

Thomas Newton, Constellation Wines Australia

Phil Nicolas, SARDI

Gary O'Neill, Elders Limited

Joanne Pech, SARDI

Paul Petrie, Fosters wine Estates

Ali Phillips, Leasingham wines

Anthony Pitt, McWilliams Wines Pty Ltd

Kevin Powell, DPI Rutherglen

Michael Pullen, VAMVVIA

Rhys Robinson, Norfolk Rise Vineyard

Simon Robinson, CSIRO

Peter Rogers, Provisor Pty Ltd

Peter Scholefield, Scholefield and Robinson Horticultural services

Lachlan Simpson, Constellation Wines Australia

Mark Thomas, CSIRO

Craig Thornton, Wingara Wine Group

Jarrod Thorpe, Constellation Wines Australia

Chris Timms, Baileys of Glenrowan Winery

Rob Walker, CSIRO

Greg Walker, SARDI

Mandy Walker, CSIRO Plant Industry

Kirsty Waller, Barossa Valley Estate

Paul Weigand, CA Henschke

Graeme Wellman, Dorrien Estate Winery

Stephen Winnall, Constellation Wines Australia

John-Ross Wood, Wine Grapes Marketing Board

Paul Wright, VINA

Appendix Two Forum Brochure