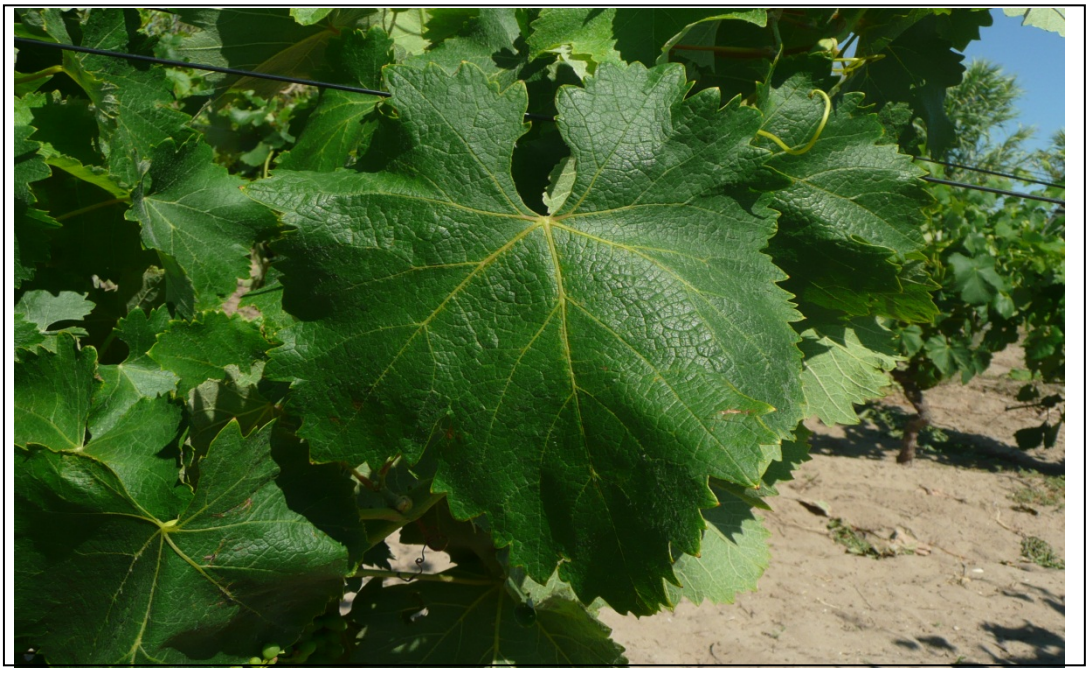
Adelaide Hills Vine Improvement Inc.

GRAPE AND WINE RESEARCH AND DEVELOPMENT CORPORATION

Ensuring Trueness to Type of some Alternative Varieties



FINAL REPORT to

GRAPE AND WINE RESEARCH & DEVELOPMENT CORPORATION

Project Number: **GWR IN1007**

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Research Organisation: Adelaide Hills Vine Improvement Inc

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ENSURING TRUENESS TO TYPE OF SOME ALTERNATIVE VARIETIES

GWRDC project Vine DNA identification project (GWR IN1007)

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This report has been prepared with all due care and consideration by Libby Tassie, Prue Henschke and David Coleman. Notwithstanding their expertise, they take no responsibility for any errors inferred and acknowledge that information cited here has come from a variety of sources and could contain errors beyond their control.

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1.0 ABSTRACT

DNA testing of a number of alternative wine grape varieties currently being planted in the wine industry was carried out to verify their trueness to type and to reduce the risk of misidentification. Results were compiled into a National Register of Wine Grape Varieties with the aim that it will be held and maintained by a relevant industry body and accessible to the industry. There was also a small comparative three way test using the known commercial DNA testing facilities in the USA, France and Australia. The project highlighted some issues surrounding the process to ensure varietal integrity for the industry and put forward a number of recommendations.

2.0 EXECUTIVE SUMMARY

This project has developed the initial National Register of Wine Grape Varieties; a data base that lists those varieties in Australia that have been DNA tested to verify their identity. This project will thus assist growers to have a high level of confidence that the specific clones of those varieties tested are true to type. With the expansion and maintenance of a National Register of Wine Grape Varieties, the significant risk that growers face in trying to be innovative and manage change in their environment via use of new varieties will be reduced.

The process raised issues of original identity of varieties and their associated clones, the importance of traceability, and of the location and maintenance of an Australian grapevine database. Some of these issues are of particular relevance to the current GWRDC Project GWR 1002 (Australian Vine Quality Standard Scheme - Vine Assurance) project, and have been discussed and referred to that project.

This project put forward a recommended sampling protocol for DNA testing to minimise the risk of off types in planting material. It is also suggested a future strategy to include in the register copies of DNA analysis, Phyotsanitary certificates, Certificate of Origin of the material and current location of the Mother vines. The requirement of a DNA test during the quarantine procedures for a newly imported variety or clone, and for those to be added to Wine Australia's list of varieties was suggested.

The project has highlighted a current gap in the industry, where there is no entity responsible for the ongoing knowledge development of new varieties to the industry or for the communication of that and related information. It has highlighted the need for one national body to coordinate and take the

responsibility for varietal integrity, which forms the backbone of the Australian Wine Industry and its Label Integrity Program. It suggests combining the two current entities in this area, VINA and AVIA, to develop a research and communication strategy to ensure integrity of the basis of the Australian industry.

This project was supported partly by GWRDC and Wine Australia with additional funding from the planting material sector of the industry, such as vine improvement bodies and nurseries, i.e., Riverland Vine Improvement Committee (RVIC), Vine Industry Nursery Association (VINA), Adelaide Hills Vine Improvement Inc. (AHVII), Barossa Grapegrower Vine Selection Society (BGVSS), Langhorne Creek Vine Improvement Committee (LCVIC), Clare Valley Vine Improvement Committee (CVVIC), Yalumba Nursery, Chalmers Nursery and Brown Brothers. Private importers Bruce Chalmers and Chris Harding covered all testing costs for their own imports. Western Australia Vine Improvement Association (WAVIA) are undertaking testing of their own material, as all their material has to be established independently to the rest of Australia.

3.0 BACKGROUND

There is currently a high level of interest in the industry in new and alternative grapevine varieties. As they are new to the industry relatively little is known of either their agronomic or ampelographic characteristics. To avoid any mistaken identity or a recurrence of the recent Albariño mistake, it is important to verify their varietal trueness to type. This project proposed to coordinate a testing of mother vines of those varieties deemed by the industry to be most in demand, by the use of DNA testing, in support of Wine Australia's Label Integrity Program, and ancillary to the current GWRDC Project GWR 1002 (Australian Vine Quality Assurance Program) carried out by Peter Hayes.

In addition there was a three way comparative test of three of these varieties (less than originally stated due to financial constraints) using the three known commercial DNA testing facilities, the Plant Identification Laboratory, Foundation Plant Services, University of California, Davis (UCD), USA, the Institut Francaise de la Vigne et du Vin (IFV), in Montpellier, France and the Australian Genome Research Facility (AGRF), in Adelaide. The other varieties went to the French testing facility only, which at this stage has been assessed as having the most extensive and verified reference data base-and is considerably cheaper.

This testing aims to develop an initial National Register of Wine Grape Varieties that will be publically accessible and held by a relevant industry body.

4.0 PROJECT AIMS AND PERFORMANCE TARGETS

The proposed outputs were as follows:

i. To initiate development of a National Register of Wine Grape Varieties to be held by a relevant industry body.

ii. The Register would allow ampelographers to establish the location of vines that have been DNA tested to enable them to use those vines as the reference vine for further ampelographic work.

iii. Initial assessment of the three commercial DNA testing facilities.

iv. Identification and reporting of any gaps in the process to ensure trueness to type of the planting material used for the Australian wine industry.

v. Final report delivered to GWRDC in hard copy and electronic format. Industry article submitted for publication with popular industry trade journal.

The timeline on completion was extended as coordination and receiving funding from industry bodies took more time than anticipated.

5.0 METHOD

The list of varieties was compiled following a survey by Adelaide Hills Vine Improvement Inc., of interested industry members to assess their requirements. Clonal material as listed in the National Register of Grapevine Varieties and Clones, (Nicholas, 2006) was used as a starting point together with those from private imports as requested. Due to time constraints, the sample was divided into two; those that could be taken during the late autumn 2011 with available material, and others taken later in spring/summer 2011.

The testing of any one variety ideally covered the available clones of the variety, with a known and traceable history of origin. The mother vines, or original plantings, of those clones were used for the sample where possible.

The method of sample selection is particularly pertinent, with essentially three different sampling methods possible.

The recommended protocol for this project to minimize risk of error in varietal identity of propagation material is to test all of the mother vines, i.e. all the vines from which the first propagation material will be taken. This is the ideal method to eliminate any possible error in the initial planting and subsequent distribution; the old Merlot /Cabernet Franc mixed plantings is an example of such a mistake in the original three mother vine planting.

The publically imported material was thus taken primarily from the mother vines in the grapevine collections at SARDI, Nuriootpa, (3 vines), and at the Australian Vine Improvement Association (AVIA) and Victorian and Murray Valley Vine Improvement (VAMVVIA) collections at Dareton, NSW (4 vines).
The decision may be made to test only one of the mother vines. In this instance, Western Australia Vine Improvement (WAVIA) chose this method in order to test a greater number of varieties initially, with the aim of revisiting and checking the remainder ampelographically, or with further DNA tests. They concentrated on alternative varieties, and in particular those that are included in the alternative variety trials at Manjimup and Wokalup (DAFWA Bulletin 4824 http://www.agric.wa.gov.au/objtwr/imported_assets/content/hort/vit/bn_alternative_varieties_booklet_2011.pdf). They took 29 varieties from the foundation block and 1 from the source block. The vine used for the testing was noted, with the logic that the remainder will be verified later. In NSW, the supposed Grenache blanc, or White Grenache, was sampled from two of the three mother vines at the Griffith NSW Department of Primary Industries research station variety collection.

As is often the case with private imports where there may be no mother vines tagged, an original vine, or number of vines, planted in a row of that variety, was sampled for the DNA test, and referenced. In the source blocks of Yalumba, for example, for material other than their ENTAV imports, which have already been DNA tested, one specific vine is tested and then the block is inspected ampelographically for off types (Nick Dry, pers. comm).

For the private imports in this project, material that was imported by Chalmers Nurseries Pty. Ltd., the VCR and MAT clones, were collected by Bruce Chalmers, with permission from the current owners of the vineyard, and sent directly to France. Three varieties in Western Australia were sampled by Chris Harding (Viticlone Supplies Nursery). The three clones of Grüner Veltliner imported by Hahndorf Hill had been tested previously as part of a joint project with Adelaide Hills Vine Improvement Inc., and the clone I14 V16 IV702236 tested at that time was from a vine sourced from AVIA, not a direct test of the mother vines.

Planting material listed in the National Register of Grapevine Varieties and Clones (Nicholas, P. 2006) from the old Merbein site of CSIRO was not available to be tested, and the vines have now been grubbed, and transferred to another site at Koorlong. No material is being released to industry from that collection at the present time.

A CSIRO project, funded by GWRDC, is being initiated that will include verification of the identity of some of those varieties in the CSIRO collection, and it is understood that at the conclusion of that multi-laboratory validation process, this should provide a testing mechanism and process to enable the release of some material to the industry.

It is important to emphasize that only those clones listed were tested and not all clones of a variety have necessarily been tested. There is no up to date, complete list of planting material in Australia that captures all the more recently, and mostly, privately imported clones.

The majority of the samples were sent to one facility, the Institut Francaise de la Vigne et du Vin (IFV), in Montpellier, France. Their DNA data base of 3,000 vines has been developed from the

collections of INRA Domaine de Vassal repository and IFV - Domaine de L'Espiguette, which are regularly looked at by French ampelographers, and is the most extensive and verified reference data base available. The collection process for that testing is via FTA cards, which require that young actively growing (preferably) material is pressed onto a well of absorbent paper and then sent via express international courier to France.

Batches of a small number of the samples, shown in Table 3, were also sent to two other DNA testing facilities in a three way test for cross referencing purposes, at the request of GWRDC. These facilities were the Plant Identification Laboratory, Foundation Plant Services, University of California, Davis (UCD), USA, and the Australian Genome Research Facility (AGRF) in Adelaide, which utilises the DNA data base developed by CSIRO from material here in Australia. For this testing process, some of the varieties and clones to be tested against the Australian data base may actually have been tested against themselves. The CSIRO project now being initiated is understood to include verifying the identification of some of the varieties in the national collection.

Grapevine material of canes, leaves and rachis were collected for testing at the two latter facilities, with the DNA extracted at the AGRF for both samples, and freeze dried DNA then sent to the UCD facility.

6.0 RESULTS AND DISCUSSION

6.1. RESULTS.

Results for the bulk of the testing are shown in Tables 1, 1a & 2, divided up in this instance according to the sampling method used. Results for the three way test of the different DNA testing facilities of France, USA and Australia are shown in Table 3.

Table 1 shows DNA testing results from collections of SARDI, Nuriootpa, and AVIA and VAMVVIA, Dareton, where all mother vines of each variety were tested. All samples tested as true to type.

Of specific interest are the clones of Fiano which all tested true to type with the Fiano in the French data base, believed to be Fiano from Avellino, in Campagna, Italy. However there is some confusion in the public arena, as there is also a variety known as Fiano di Bari, or Minutolo, grown in the Puglia region and there is conjecture that they are the same variety. This confusion is currently being addressed in a separate project, by one of the authors with Italian and French colleagues, with the additional DNA testing funded by Adelaide Hills Vine Improvement Inc.

There are two specific naming issues raised in this table, where, according to the paper work, Grüner Veltliner is known as Green Veltliner, and there has been some confusion over the name of Vermentino and Rolle, which are actually just synonyms, with the internationally recognized name of Vermentino becoming common usage.

Table 1a lists the results where only one of the mother vines was sampled and tested. If the other mother vines of each variety are tested and all the original source of propagation material is thus tested to be true to type, they will then be moved up into Table 1.

The supposed Grenache Blanc in this table tested as Grenache, but the colour was not differentiated, as can occur with varieties with different fruit colour. From photos of the fruit it appears to be more grey than white. Greater definition of this result is still required.

Results from the WAVIA testing will be available shortly, and will be listed in Table 1a on the public data base.

Table 1. Varieties and clones DNA tested for trueness to type at the French testing facility, IFV, Montpellier, with all mother vines tested from public collections.

Variety	Clone/Accession no.	Possible location of "mother vines"	Tested; source & date	Result
Reds				
Aglianico	FPS01	CSIRO, AVIA, VAMVVIA	VAMVVIA, Dareton,NSW 12/2011	True to type
Lagrein	H9V7 / IS748094	SA	SARDI, Nuriootpa, SA 4/2011	True to type
Montepulciano	Rydalmere / IC788469	CSIRO, SA	SARDI, Nuriootpa,SA 4/2011	True to type
	Rydalmere FSAC / IC788469	CSIRO, AVIA	AVIA , Dareton, NSW 12/2011	True to type
Saperavi	I 11V10 / IS 76 8246	SA	SARDI, Nuriootpa,SA 4/2011	True to type
Whites				
Arneis	CVT CN15	AVIA, SA, WA	SARD, Nuriootpa , SA 4/2011	True to type
	CVT CN 19	AVIA, SA	AVIA, Dareton ,NSW 12/2011	True to type
Fiano	Merbein IC 788456	CSIRO, SA, WA	SARDI, Nuriootpa , SA 4/2011	True to type
	FSAC /IC788456 (?)	CSIRO, AVIA	AVIA, Dareton, NSW 12/2011	True to type
Grüner Veltliner	I14V16 IS 852236	SA, listed as Green Veltliner	SARDI, Nuriootpa , SA 4/2011	True to type
Vermentino	Rolle- H62.1.LN/CX/UCD IS788245- Rolle syn	SA	SARDI, Nuriootpa,SA 4/2011	True to type

Table 1a. Varieties and clones DNA tested for trueness to type at the IFV, Montpellier, France, with not all mother vines tested from public collections.

Variety	Clone/Accession no.	Location of mother vines	Tested; source & date	Result	Other comments
Reds					
Whites					
Grenache blanc	White Grenache NSW	Griffith, NSW	NSW DPI res stn , Griff, 4/2011, 2 of 3 vines tested	Grenache Gris? revisit	thought to be gris from photos

Table 2 shows the results from testing where there are no absolute mother vines e.g., those from private importers who generally tested what they considered to be the most original vine. Two samples, Negro Amaro VCR10, and Sagrantino, a WA private import from Umbria, needed to be resubmitted; the Sagrantino tested as true to type, and the Negro Amaro result is still pending and will be added to the public data base.

One sample, Teroldego, a WA private import, tested as not true to type, and the vines from that sample have subsequently been destroyed.

All other varietal clones sampled thus far in the project tested as true to variety, with some further clarification required on the Grenache blanc / gris.

Table 2. Varieties and clones from primarily private sources DNA tested for trueness to type at the French testing facility, IFV in Montpellier, with one of the most original vines tested.

Variety	Clone/Accession no.	Location of mother vines	Tested; source & date	Result	Other comments
Reds					
Aglianico	VCR11	Euston, NSW	ex Chalmers vyd , Euston 4/2011	True to type	
	VCR13	Euston, NSW	ex Chalmers vyd , Euston 4/2011	True to type	
	MAT2	Euston, NSW	ex Chalmers vyd , Euston 4/2011	True to type	
	MAT3	Euston, NSW	ex Chalmers vyd , Euston 4/2011	True to type	
Ciliegiolo	WA private import	Viticlone Supplies Nursery,WA	Chris Harding, WA 1/2012	True to type	
Montepulciano	MAT2	Euston, NSW	ex Chalmers vyd , Euston 4/2011	True to type	
Nero d'Avola	MAT1	Euston, NSW	ex Chalmers vyd , Euston 4/2011	True to type	
Negro Amaro	VCR10	Euston, NSW	ex Chalmers vyd , Euston 4/2011	resubmit	
Sagrantino	MAT1	Euston, NSW	ex Chalmers vyd , Euston 4/2011	True to type	
	MAT4	Euston, NSW	ex Chalmers vyd , Euston 4/2011	True to type	
	WA private import	Viticlone Supplies Nursery,WA	Chris Harding, WA 1/2012	True to type	
Teroldego	WA private import	Yallingup, WA	Chris Harding, WA 4/2011	Chardonnay	Offtype; subsequently destroyed
Whites					
Fiano	VCR 3	Euston, NSW	ex Chalmers vyd , Euston 4/2011	True to type	
Garganega	Rauscedo 4	Euston, NSW	ex Chalmers vyd , Euston 4/2011	True to type	
Greco	VCR 5	Euston, NSW	ex Chalmers vyd , Euston 4/2011	True to type	
Grüner Veltliner	I14 V16 IV702236	CSIRO, SA, Tas	Vinewright Nursery, SA, pre 2011	True to type	Material of AHVI ex CSIRO/AVIA . Known to have GLRaV 9
	HHW 3		Vinewright Nursery, SA, pre 2011	True to type	Material of Hahndorf Hill Winery
	HHW 2		Vinewright Nursery, SA, pre 2011	True to type	Material of Hahndorf Hill Winery
	SEL IBY clone		Vinewright Nursery, SA,pre 2011	True to type	Material of Hahndorf Hill Winery
Prosecco	VCR 101	Euston, NSW	ex Chalmers vyd , Euston 4/2011	True to type	
Vermentino	VCR 1	Euston,NSW	ex Chalmers vyd , Euston 4/2011	True to type	

The three - way test of the different commercial DNA testing facilities of France, USA and Australia shown in Table 3 indicated the three varieties tested were true to type, with results consistent across the testing facilities.

Table 3. Results from the three way tests at the three different testing facilities: IFV, Montpellier, France, at UCD, US, and at AGRF, Adelaide.

Variety	Clone/Accession no.	Possible Location	Collection point	Results from all three testing facilities
Reds				
Montepulciano	Rydalmere IC788469	CSIRO, SA	Nuri - PIRSA, SA	True to type
Whites				
Fiano	Merbein IC 788456	CSIRO, SA, WA	Nuri - PIRSA, SA	True to type
Vermentino	IS 788245	Nuri SA,	Nuri - PIRSA, SA	True to type

6.2 DISCUSSION

It is pertinent to discuss some issues that have emerged from this project that are of relevance for the method of DNA testing, or for the interpretation of the results, and their implications.

The issues included:

- clonal naming and traceability or origin of the material,
- accurate naming and who in the industry is responsible for maintaining correct records,
- establishment of a mechanism for reporting errors in varietal identification and dissemination of that information,
- potential for making DNA testing a requirement as new material is brought into Australia through quarantine,
- which sampling methodology gives the most acceptable level of risk management and how are the results of the DNA tests interpreted by the buyer of the material.

Clonal naming with both clone and accession numbers – at least for the public imports - is relevant for tracing back to the best material to take for testing and for interpretation of the results of the testing. Many varieties imported into Australia were located at CSIRO, Merbein, i.e. a Commonwealth import, and thus have the prefix of IC and date of importation on the accession number. They may have then been imported from Merbein into, for example, South Australia and planted in the mother vine collection at SARDI, Nuriootpa. A different accession number with the prefix of IS and a later date, was then given to the import but the serial number (last 4 numbers) and the clone name was retained. This has kept track of the clonal movement in those cases. With Lagrein, for example, there is clone H9V7 IC698094, as well as clone H9V7 IS748094 and the assumption is that these two are the same clone but of subsequent generations.

Only those accession numbers noted in Table 1 as being tested can absolutely be verified as true to type from this project, so if there was an error in a later accession of that clone, this will not be

picked up. Additionally, testing a later accession number cannot necessarily ensure that all three mother vines of the earlier planting were true to type.

This also underlines the importance of traceability of clonal material and retention of the correct and original name. There is some naming reference to "clone" FSAC with some of this material, which merely indicates that the material has undergone the process of Fragmented Shoot Apex Culture to eliminate viruses. The clone should still retain its original clonal name, together with the FSAC note. The Fiano clone, noted as FSAC in the National Register of Grapevine Varieties and Clones, (Nicholas, 2006) is apparently the Merbein clone, accession number of IC788456 (Hilary Davis pers comm).

Retaining the original clonal identification (as registered under European regulations) gives the grapegrower the history of the performance of that particular clone. The importance of this appears to be addressed by the Australian Vine Quality Standard Scheme - Vine Assurance project. Currently clones can generally not be detected by DNA fingerprinting, however some Syrah clones have recently been identified in France (Audeguin & Boursiquot, 2008). The importance of clonal identity is also emphasised with DNA testing in Italy revealing that one supposed biotype of Nebbiolo, Nebbiolo Rose with three named clones within that biotype, has proven to be closely related to, but is a different cultivar from the other biotypes of Nebbiolo, and may be either the parent or generation one of Nebbiolo (Botta et al., 2000).

Maintaining a data base of the correct names is also an issue, with incorrect naming leading to confusion.

With the current interest in international varieties, such as Grüner Veltliner, naming confusions require some clarification. For example in the National Register of Grapevine Varieties and Clones, 2006 edition, there are 3 Veltliners – green, white and red – all with different Accession Numbers. It seems that White and Green Veltliner are most likely synonyms of Grüner Veltliner, whereas Red Veltliner is a synonym of Roter Veltliner according to the Vitis International Variety Catalogue (VIVC), with rose instead of white, coloured berry skin. In addition, the Grüner Veltliner clone FVI4V16 IC702236 was evidently the original CSIRO importation, but the clone I14 V16 IV702236 is listed in the National register for South Australia, Tasmania, and Western Australia. This could be a typographical error, as it appears to be FV14V16 with the same last 4 numbers in the accession number, 2236, and the relevant importation numbers.

Responsibility for varietal listings for the industry is of particular concern, especially under the Label Integrity Program which is overseen by Wine Australia. After the closure of the national collection at CSIRO, Merbein, where the most extensive records on many of our varieties had been held, the wine industry has presumably been left without a technical position responsible for the collection administration and register. Despite discussion by industry leaders in recent years on the future of grapevine variety collections, the gradual decline of capability with regard to collections management continues to occur. It seems imperative to maintain capability in this area to avoid the possibility of future misidentification of varieties.

There is currently no clear mechanism for reporting errors in varietal identification and dissemination of that and other varietal information. In the absence of a national body with the recognised responsibility for the area of propagation material, this is a gap in the industry that needs to be addressed.

Along with the recent identification mistakes in the industry and the relatively recent commercialisation of DNA testing, it is an appropriate time to make DNA testing of any newly imported variety a requirement during the quarantine process where a limited number of mother vines (usually 2) are released to the importer. This would alleviate the catch up mode in which the industry now finds itself and would prevent the propagation of misnamed varieties. There may be more incentive to do so if DNA identification is part of the Vine Assurance Standard.

An issue the grower needs to be mindful of when determining if their material has been tested for varietal integrity, is, which DNA sampling methodology is most acceptable for an optimum risk management strategy, and how are the results of the DNA testing to be interpreted with respect to sampling method and place of testing?

Put simply, what questions does the grape grower need to ask to confirm that the original source of their planting material is true to type?

This will be addressed in the outcomes section.

7.0 OUTCOMES

This project has essentially achieved against planned outcomes, i.e.

I. To initiate development of a DNA National Register of Grape Vine Varieties to be held by a relevant industry body.

ii. The Register would allow ampelographers to establish the location of vines that have been DNA tested to enable them to use those vines as the reference vine for further ampelographic work.

iii. Initial assessment of the three commercial DNA testing facilities.

iv. Identification and reporting of any gaps in the process to ensure trueness to type of the planting material used for the Australian wine industry.

Issues pertaining to those outcomes are as follows.

Optimum methodology for the DNA testing process.

1. **Sampling method for DNA testing.** The ideal method for ensuring trueness to type of a variety using DNA testing is applying a consistent and transparent method that gives growers maximum assurance that the ultimate source of the planting material is indeed true to type, with the least

margin for error. As outlined in the methods section, it is recommended to test all of the mother vines, i.e. all the vines that the first propagation material will then be sourced from.

The other less rigorous methods which rely on testing only one of the mother or source vines have a greater potential risk of error. These methods require follow up with ampelography or DNA testing of other vines used as source for propagation material to ensure its trueness to type. If the single DNA tested vine is to be used as the reference to determine the varietal ampelographic characteristics it must be noted that this requires a high health reference plant and in addition, one plant may not a large enough sample number from which to take observations, particularly in a highly variable variety.

In the situation where there are no mother vine plantings DNA testing on just one vine from the original planting only indicates that at least one of the original planting material is true to type. There is also a risk that the original plantings of private material will be removed and the reference vine will be lost.

2. **The place of testing.** This project was required to undertake a 3- way validation test with the currently available commercial testing facilities in France, USA and Australia. With the limited varietal samples, results from each facility were consistent although the sample number was too small to rigorously test the reliability of each facility.

The French testing facility has a very extensive and verified data base of 3,000 varieties, developed from the collections of INRA Domaine de Vassal repository and IFV- Domaine de L'Espiguette, which are regularly looked at by French ampelographers. It also provides the least expensive DNA testing service.
The data base of the AGRF, developed by CSIRO, includes about 200 of the most commonly used varieties based on the collection at Merbein that had not recently been ampelographically verified. As previously mentioned, sending some of the Australian varieties to that data base would be testing them against themselves. The current project by CSIRO, funded by GWRDC, is understood to work towards verifying the identification of some of the varieties held in the old collection and used in that data base.
The US data base has over 1,200 varieties, with the initial DNA profiles taken from 500 vines in the Montpellier collections and others from their own work, collaborations and published data as well as publically available on-line databases of grape DNA profiles, covering most of the prominent collections (Jerry Dangl, pers comm).

Extensive varietal work has been undertaken with both ampelographic and molecular techniques in Europe, and the DNA profiles subsequently agreed upon for the Vitis data base within the European Union (EU) group. That fact, together with the above factors, and given the current DNA testing techniques most commonly used, led this project to send most of the samples to the French facility.

Ampelographic expertise

The need for some ampelographic expertise to confirm other source vines, or identify off types in source blocks is an issue that needs addressing; is it an area that is required and if so, how is it to be supported?

Traceability

Traceability of material is critical for the grower to have maximum confidence in their planting material. An improved paper trail is currently required for the industry which is to some degree being addressed by the Australian Standards project and the VINA Accreditation Scheme, but needs to be taken up by importers and propagators with some urgency.

Climate change and Limiting Factors to Changing Varieties

A broad issue that comes out of this project is whether the Australian wine industry is prepared for the next phase to manage the challenges of climate change in a changing market place. Does industry have sufficient choices of high health, true to type, desirable varieties for those challenges? Further, does industry have a good information system on material nomenclature, health status, traceability, agronomics and its availability? The importance of this is highlighted at the time that both the CSIRO collection and the other public collection of SARDI at Nuriootpa are currently closed to the industry.

Location of a National Register

A major outcome of this project is to pose the question of where this information on varietal trueness to type verification is to be held. The location and maintenance of this data base as a public industry resource still needs to be resolved. Discussion is being undertaken to determine where this may best be held, with AVIA and its affiliates continuing to drive the discussions about who has the responsibility for managing the situation.

Recent work on alternative varieties has increased the availability of information on varieties generally. However information on what is available in Australia, and how it performs, is still in piecemeal form. An example of an industry information resource is available for the USA industry at http://www.ngr.ucdavis.edu/index.

This project has raised the awareness of DNA testing and a number of growers have used it to check the identity of planting material before committing to planting of relatively unknown varieties.

There are obvious advantages for the industry in a collaborative project such as this, but with little funding, the time & effort to do so highlights the need for a well-coordinated system that does not currently exist in the industry.

8.0 RECOMMENDATIONS

1. The recommended protocol for proof of grape vine varietal identity outlined in the method of this project is adopted into the proposed Australian Vine Quality Standard (Project GWR 1002).
2. A National Register of the complete list of all grape vine varieties and clones including private and recently imported material is maintained (currently under copyright of AVIA and an addendum of clones under copy right of SARDI). Included in the register should be copies of DNA analysis, Phytosanitary certificates, Certificate of Origin of the material and current location of the Mother vines (with restricted access for biosecurity and privacy reasons).
3. Formulate a protocol for clonal naming that recognizes the original scientifically based and registered clonal name from the country of origin as the preferred clonal name.
4. Add to the quarantine procedures the requirement that any newly imported variety or clone be subject to a DNA test prior to the release of the Mother vines from quarantine and this Proof of Identity Certificate be lodged with the National Register.
5. Introduce DNA testing, or Proof of Identity certificate as a requirement for a new variety to be added to Wine Australia's Approved List of Varieties and held as legal documents by Wine Australia.
6. As there is still a need for ampelographic assessment of variability, colour and health status of the reference stocks, that planning includes provisions for an ampelographer in the form of training, as a paid consultant or bringing in expert ampelographers from overseas.
7. Reporting and dissemination of information on any new or misidentified varieties and clones be made the responsibility of Wine Australia under its Label Integrity Program, working together with a national vine foundation such as AVIA.
8. Reinstate the national vine foundation access to the defunct collections of CSIRO and SARDI Nuriootpa, following DNA and Phytosanitary testing.
9. Fund the administration of a national vine foundation such as a combined AVIA and VINA through industry levies to ensure these recommendations are adopted.

9.0 Appendix 1: Communication

The outcomes of this project have been communicated via the following channels;

Two articles;

Tassie, L. (2011) Ensuring Trueness To Type of some Alternative Varieties; Report from the "Pilot Varietal Verification Project"; Part I. Wine & Viticulture Journal, Nov-Dec. Vol 26. No.6

Tassie,L., Henschke,P., Coleman, D. (2012) Ensuring Trueness to Type of some Alternative Varieties; Part 2 of the "Pilot Varietal Verification Project"; *What does it mean to the grower?* Wine & Viticulture Journal, in print.

Meetings with Peter Hayes, GWRDC.

Copies of results and, or, articles sent to providers of material and, or, funds.

Planned meetings and discussions of the project with AHVII/AVIA/VINA to discuss recommendations with project coordinators attending those meetings.

10.0 Appendix 2: Intellectual Property

This process and results are limited to the technology of the day, and results valid for the current methodologies of DNA testing used.

There may be potential to link this data base with that of Wine Australia to streamline the Label Integrity Programme, the List of Recognised Varieties and the AQIS Privacy Act, with the appropriate limitations that may incur.

11.0 Appendix 3: References

Audeguin, L. and Boursiquot, J-M. (2008) Ampelography Workshop. ENTAV – INRA. Nov 18 - 20, Yalumba Nursery, Barossa Valley.

Botta, R., Schneider, A., Akkak, A., Scott, N.S., Thomas, M.R. (2000) Within cultivar grapevine variability studied by morphometrical and molecular marker based techniques. Acta Hort., 528, 91-96.

DAFWA Bulletin 4824 [www.agric.wa.gov.au/objtwr/imported_assets/content/hort/vit/bn_alternative_varieties_booklet_2011.pdf]

Nicholas, P. (Ed). (2006) National Register of Grapevine Varieties and Clones.

Vitis International Variety Catalogue [www.vivc.bafz.de/index.php]

12.0 Appendix 4: The funding for this project was a cooperative effort with GWRDC, Wine Australia and other industry organisations. Thanks go to those who contributed as listed in the body of the text. Also thanks to Jason Capella, NSW DPI Extension Viticulturist and Hilary Davis of VAMMVIA/AVIA for collection of some samples. The project was coordinated by Adelaide Hills Vine Improvement Inc. with Libby Tassie undertaking the technical role, David Coleman as budget manager and Prue Henschke as project convener.