THE AUSTRALIAN WINE RESEARCH INSTITUTE

ANNUAL REPORT 2021




"Following the major challenges of the previous year, 2020/2021 has seen some positive news for the Australian wine industry, with excellent growing conditions and a record-breaking vintage. This has been tempered by the continued challenges in export markets after the imposition of tariffs by China. As COVID-19 restrictions ease around the world, it is hoped that Australian wine will be able to take advantage of more positive consumer sentiments and greater freedoms. At the AWRI in 2020/2021 there has been strong progress across a range of areas, with highlights in sustainability, industry support, smoke research, collaborations and new capabilities." - Dr Mark Krstic, Managing Director

ADVANCES IN SUSTAINABILITY

In August 2020 Australian Grape & Wine, the AWRI and Wine Australia signed a Memorandum of Understanding outlining the collaborative arrangements for governance and delivery of the national sustainability program, Sustainable Winegrowing Australia. The formalisation of this collaboration has clarified the roles of the three organisations, strengthened the program and contributed to significant progress during the year. Membership increased by 23% to 631 in 2020/2021, split across 90% vineyard members and 10% winery members.

INCREASED ONLINE PRESENCE

A key aspect of the AWRI's response to the ongoing COVID-19 pandemic has been an increased focus on virtual platforms. A large percentage of extension events in the past year, including tastings, have been delivered online, working with new partners to ensure tasting samples of wines can be efficiently sent to participants across Australia and received in good condition. Webinars have greatly increased in popularity, both in terms of live attendance and views of recordings on YouTube. Very strong increases have also been observed for views of the demonstration videos recorded over the past two years, confirming the usefulness of this virtual format. A new podcast, 'AWRI decanted', is in preparation, to further expand the AWRI's digital presence. In addition, the ShowRunner wine show and classification software has been completely transitioned to an online product, which allows show organisers to run the software themselves, no matter where in Australia they are located, with online support provided remotely by AWRI staff. International collaborations have also been maintained successfully through online meetings and conferences, along with ongoing contributions to international regulatory forums.


RESPONSE TO COVID-19

Impacts of the global COVID-19 pandemic have continued to be felt across Australia and around the world. Lockdowns, border closures and travel restrictions affected everyone, including the AWRI and the delivery of its national activities. Workplace policies and processes developed early in the pandemic have made it easier to adapt to changing conditions as the situation has evolved and staff have continued to demonstrate resilience and positivity when dealing with change.

SMOKE SUPPORT

While Australia was fortunate not to have a high-risk fire season in 2020/2021, ongoing support was provided to those affected by the 2020 fire season, on an individual basis and via state-based programs. Some US producers, affected by severe fires along the western seaboard, also accessed the AWRI's analytical capabilities. Throughout NSW, Victoria and SA, assistance was provided to set up regional sensory panels for assessing 2020 wines and a new method for smoke sensory analysis was formalised.

TECHNICAL TRENDS FROM THE AWRI HELPDESK

As in previous years, the queries received by the AWRI helpdesk reflected technical issues encountered during the year and were strongly influenced by the weather conditions of the growing season and vintage. In late September 2020, the Bureau of Meteorology declared that a La Niña event would occur during the 2020/2021 growing season and bring with it cooler and wetter conditions. This contributed to a slow and delayed ripening season where many producers experienced even ripening, with fruit flavour and tannin ripeness occurring before sugar ripeness. Fewer heatwaves and an extended growing season also saw fewer stuck fermentations and associated problems. Higher acidity levels were reported by some producers, resulting in high initial titratable acidities in must and larger than usual pH increases post-malolactic fermentation. Overall, producers reported both exceptional fruit quality and high yields. Wine Australia's national vintage survey estimated an Australian wine-grape crush of 2.03 million tonnes, the largest ever recorded, 17% above the 10-year average of 1.74 million tonnes.

LOOKING TOWARDS VINTAGE 2022

The El Niño–Southern Oscillation (ENSO) system is currently neutral but the chance of La Niña conditions in the coming months has increased. This may increase the chance of above-average rainfall from November to January for the eastern two-thirds of Australia, as well as northern and south coast areas of WA.

At the AWRI, 2021/2022 will see:

- Conclusion of a suite of Wine Australia-funded research projects and continued refinement of a project portfolio for a new investment agreement with Wine Australia
- Ongoing strategy development and implementation, particularly for AWRI Commercial Services
- Delivery of the 18th Australian Wine Industry Technical Conference and Trade Exhibition in conjunction with the ASVO, Australian Grape & Wine, WISA and Expertise Events.

HIGHLIGHTS OF THE YEAR

CUSTOMERS, CONSUMERS AND MARKETS

INTERNATIONAL SMOKE WORKING GROUP

The AWRI initiated a FIVS Scientific and Technical Committee working group on the impacts of smoke on grape and wine production. This group is working on formulating international guidance on research priorities, defining chemical markers for analysis of smoke impacts, developing performance criteria for laboratories offering smoke testing and coordinating an international laboratory proficiency testing program.

REGISTRATION OF NEW AGROCHEMICALS

Support was provided for the registration of four new active constituents (eugenol, geraniol, thimol and fluopyram) for use in wine-grape production. Data on their impact on fermentation, sensory properties and residues were assessed and decisions about withholding periods were made by the Agrochemical Reference Group.

ENERGY CONTENT CALCULATIONS INVESTIGATED

In response to pressure to provide consumers with more information, data from large numbers of samples were analysed to understand contributions to energy content from different wine components. Results showed that the dietary energy content of wine can be calculated to an appropriate degree of accuracy based on measured values of alcohol and sugar, combined with generic values for the glycerol and organic acids. Further investigations showed that for all but the sweetest of wine styles, generic values for energy content based on wine style are also an acceptable option.

UPDATED AGROCHEMICALS APP LAUNCHED

Work on the AWRI's databases of agrochemical and maximum residue limit (MRL) information allowed them to be merged into a single system. This change improved the functionality of the AWRI's online search facility and supported the launch of an updated agrochemical app, which allows users to perform agrochemical and MRL searches from a single platform.

STRATEGIES FOR MANAGING MANCOZEB RESIDUES

Targeted analysis of selected wines and collaboration with a chemical manufacturer on vineyard trials provided greater understanding of the residue profile of mancozeb in Australian wine, enabling development of informed strategies to manage residues.

EXTENSION, ADOPTION AND EDUCATION

WEBINARS

Twenty-one webinars were presented to a total of 2,199 attendees – a 67% increase in attendance from the previous year. Views of webinar recordings on the AWRI's YouTube channel also increased significantly from 19,400 views in 2019/2020 to 53,499 views in 2020/2021.

SEMINARS AND WORKSHOPS

Seven roadshow seminars and eleven workshops were presented in 2020/2021 to a total of 337 attendees, in a mix of face-to-face and virtual formats.

WEBSITE

More than 177,525 visitors accessed the AWRI website during the year with more than 604,635 page-views. New content was added on topics including smoke taint (particularly following early-season smoke exposure), sustainability, vineyard management practices and brown marmorated stink bug biosecurity.

WINE EDUCATION

For the first time, three Advanced Wine Assessment Courses were delivered in successive weeks, providing 48 attendees with the opportunity to improve their tasting skills and gain a greater understanding of wine show judging.

VIDEOS

Following the success of the previous year's pilot video project, four new videos were produced and uploaded to the AWRI's YouTube channel. Demonstration videos on the AWRI's YouTube channel were viewed more than 69,900 times, illustrating the popularity of this format.

ONLINE VITICULTURE CONTENT

A restructure of viticulture content on the AWRI website was completed, making it easier for growers to find relevant information.

REFRESHED WINEMAKING CALCULATORS APP

A refreshed version of the AWRI's popular winemaking calculators app was released, offering a new total package oxygen calculator and an improved fining trial calculator.

HELPDESK SUPPORT

The AWRI helpdesk responded to 2,431 enquiries in 2020/2021, fewer than the long-term average. The observed drop in enquiry numbers is likely due to the near ideal growing conditions, which led to a vintage of exceptional fruit quality. Sustainability enquiries continued to grow, almost doubling compared to last year, and reaching more than 1,000 for the first time.

PRACTICE CHANGE FOCUS

New practice change priorities of oxygen use in winemaking and irrigation efficiency were identified through consultation with Wine Australia and industry stakeholders. Programs of activities and packaged materials to promote adoption of these practices were launched during the year, including irrigation workshops held with producers in the warm inland regions.

LIBRARY SERVICES

In 2020/2021 the library responded to 1,059 reference and information requests and delivered 2,474 articles in response, similar numbers to the previous year. The number of articles requested from the current literature presented in *Technical Review* increased by 137. The number of requests for resources from online information packs increased by more than 30%, with 213 more articles delivered than the previous year. Usage of the staff publication database also increased by 17.5%. Library staff performed 30 specialised literature searches on a variety of topics across winemaking, vineyard management, winery operations and pest management.

PERFORMANCE, PRODUCTS AND PROCESSES

FOLIAR SPRAYS TRIALLED IN COMMERCIAL VINEYARDS

Trials with industry partners assessed simple foliar sprays under commercial conditions in Chardonnay and Sauvignon Blanc vineyards in Padthaway. Positive feedback has been received on the effects on wine flavour and the practicality of the spray regime required. This topic has been proposed as a potential future practice change priority.

NEW ANALYTICAL METHODS FOR 'RAISIN'/'JAMMY' FLAVOURS

'Dried fruit' and 'jammy'/'cooked fruit' sensory attributes in warm climate Shiraz grape berries were related to specific volatile compounds, and new analytical methods to quantify their levels were developed.

RAPID METHOD FOR AMINO ACID QUANTIFICATION

Using a newly acquired nuclear magnetic resonance instrument, a simple and rapid method requiring minimal sample preparation was developed to measure the concentration of specific amino acids that are related to desirable flavour properties in red wines.

IMPROVED PREDICTION OF BOTTLE AGEING OUTCOMES

The kinetics of release of monoterpene 'floral'/'citrus' aroma compounds from glycosides was characterised, which will assist future accelerated ageing studies to better predict outcomes following bottle storage.

EXPLORING BITTER AND 'SAVOURY' CHARACTERS

The bitter tasting compound tryptophol sulfonate is only likely to be perceived by sensitive tasters in white wines produced with high levels of the precursors tryptophol and SO_2. Tryptophol sulfonate formation after bottling in red wines does not occur to any practical extent, which is most likely due to binding of SO_2 by red wine components. A potentially new bitter compound in wine was identified and a preparative-scale synthesis method was developed and implemented to achieve sufficient quantities for sensory assessment. The concentration distributions and ranges in Australian wines of potential contributors to 'savoury' character were determined for use in future investigations.

  

ANTHOCYANIN'S ROLE IN COLD STABILITY
Monomeric anthocyanin was found to be critical to protect red wines from cold instability, and its conversion to other forms during wine processing may underpin late-stage cold instability issues.

ONGOING ADVANCES IN HEAT STABILISATION
A fluorescent dye specific to haze-forming proteins in white wine provides a new, rapid screening tool for heat instability.

MACERATION TECHNIQUE IMPROVES LOW-PHENOLIC RED GRAPES
Accelerated maceration was found to enhance the extraction of colour and tannin from grapes of low phenolic potential.

AERATION EFFECT IN WHITE 'WILD' FERMENTS
Aeration of white non-inoculated ferments was shown to reduce fermentation times with minimal changes to wine composition.

NO- AND LOW-ALCOHOL PROJECT LAUNCHED
Sensory assessment of more than 90 no- and low-alcohol products was completed to better understand the product category and an industry reference group was established to help guide this new project.

INTERSPECIFIC HYBRIDS INVESTIGATED
The heritability of the low acetic acid production trait in an *S. cerevisiae* x *S. uvarum* hybrid was demonstrated, and the genetic basis of the trait was shown to be related to the retention of a single chromosome. In addition, a direct comparison of seven interspecific yeast hybrids in red wine production was completed, allowing hybrid yeasts that appear well suited to red wine production to be identified.

HIGH-THIOL-PRODUCING YEASTS IN WINEMAKING
High-thiol-producing yeasts, previously thought of as tools for the production of white wines such as Sauvignon Blanc, were shown to be suitable for the production of red wines. Thiol compounds that contribute 'tropical' characters in white wines were shown to increase 'red fruit' characters in Pinot Noir and Grenache.

OENOCOCCUS OENI STRESS RESPONSE
Analysis of *Oenococcus oeni's* response to SO_2 demonstrated that these bacteria have minimal capacity to deal directly with higher SO_2 concentrations but instead rely on general stress response mechanisms to deal with the damage caused.

NEW UNDERSTANDING OF CO-INOCULATION
Transient acetaldehyde production by yeast has been correlated with *O. oeni* survival during yeast/bacteria co-inoculation. It appears this may help to protect *O. oeni* against elevated SO_2 concentrations. In addition, strain-specific fitness profiling of *S. cerevisiae* yeasts has shown that some strains are more able to cope with environments where other genera of yeasts are resident. This work has implications for the application of non-*Saccharomyces* yeast as co-inoculants in fermentations.

INSIGHT INTO TERROIR
Re-analysis of historical grape compositional data has shown that non-targeted analytical approaches can effectively overcome within-vineyard or sub-regional variation, providing a stronger 'chemical fingerprint' to define terroir.

ADDRESSING ACCC MARKET RECOMMENDATIONS
A range of standardised methods for grape assessments were developed including for total soluble solids (TSS), pH, TA and colour, to address situations where these measurements are used as part of the criteria for setting payment or rejecting grapes. Protocols were also developed for sampling in vineyards, in wineries and at the weighbridge; the assessment of matter other than grapes (MOG) at the weighbridge; and the evaluation of wines for the presence of specific sensory attributes, particularly those arising from the effect of smoke in vineyards.

FURTHER UNDERSTANDING OF SO_2 TOLERANCE IN *BRETTANOMYCES*
Sulfur dioxide-tolerant industry isolates and laboratory-evolved SO_2-tolerant strains were both shown to have amplification of the SO_2-transporter (*SSU1*) gene, indicating that this may be a key aspect in the development of tolerance to this important antimicrobial preservative. This discovery will help guide future work.

YEAST STRAIN INFLUENCE ON VOLATILE SULFUR COMPOUNDS
Of 15 yeast strains screened in Pinot Noir must, only one produced quantifiable benzylmercaptan (the compound responsible for 'struck flint' character in wine), and this correlated with the H_2S production of the strains. Three alternative genes to yeast alcohol acetyltransferase (*ATF1*) have been identified that might be responsible for the formation of the undesirable volatile sulfur compounds, methanethiol and methylthiolacetate.

NEW CANNING CAPABILITY
AWRI Commercial Services has developed a state-of-the-art small-scale canning unit that can be used to package wine-based products into can with best-practice packaging processes.

EFFECTS OF EARLY-SEASON SMOKE EXPOSURE
Research conducted during the 2019/2020 bushfire season showed that pre-veraison smoke exposure can result in increased smoke markers in grapes and wine, and noticeable smoky attributes in wine. Content on the AWRI website and in fact sheets was updated to reflect these findings, which contradicted earlier beliefs about the risk of early-season smoke exposure.

ASSESSMENT OF SMOKE MARKERS
The existing suite of smoke markers was found to predict smoky flavour well, with a high degree of correlation between smoke markers, based on 23 Adelaide Hills wines and an additional 42 wines made from smoke-affected grapes from SA, NSW, ACT and Victoria.

ENVIRONMENT, SUSTAINABILITY AND NATURAL CAPITAL

SUSTAINABLE WINEGROWING AUSTRALIA
A new standalone website for Sustainable Winegrowing Australia was launched in April 2021. The program trust mark completed registration with IP Australia in December 2020 and has been accepted in the EU, UK, NZ and the USA. During the year, 17 applications for use of the trust mark on wine labels by certified members of the program were approved and 38 farmgate signs featuring the trust mark were delivered to certified members.

GRANTS TO SUPPORT SUSTAINABLE WINEGROWING
The AWRI assisted with several successful grants to support the adoption of Sustainable Winegrowing Australia in Langhorne Creek, the Barossa, Adelaide Hills, McLaren Vale and Margaret River.

CLONAL MAPPING OF PINOT NOIR
Key sources of Pinot Noir germplasm have been targeted for whole-genome sequencing in collaboration with Adelaide Hills Vine Improvement Incorporated. Clonal identification will be determined through assessment of clone-specific genetic variation.

MAPPING THE MICROORGANISMS IN A WINERY

The ability of metagenomic techniques to map winery-resident microflora was demonstrated. Key findings were that microbial communities changed over time and space, and that some populations persisted over several months. It was also possible to identify locations inhabited by spoilage microorganisms, which could be targeted with cleaning procedures to reduce the risk of wine spoilage.

LATE HARVEST DATE KEY TO HIGH 'PEPPER' CONCENTRATION

A very late harvest date was demonstrated as being key to achieving elevated grape rotundone concentrations. This is because extensive formation of the immediate rotundone precursor α-guaiene, and subsequently rotundone itself, typically only commences well after veraison. The importance of harvest date provides an explanation as to why higher grape rotundone, and consequently 'peppery' aromas in wine, are typically found in very high premium Shiraz from cool-climate regions where such late harvest is commercially viable.

TRUNK DISEASE GENOMIC VARIATION ASSESSED

Genome sequences have been obtained for 44 isolates of *Eutypa lata*. Patterns of genetic variation are being used to investigate associations with key markers of pathogenicity.

FOUNDATIONAL DATASETS AND SUPPORT SERVICES

GROWTH FOR AWRI COMMERCIAL SERVICES

In 2020/2021, the Commercial Services laboratories processed 28,710 samples, 16% higher than the 2018-2020 average of 24,754. A total of 212 new customers were added.

EXPANDED SENSORY CAPACITY

Expanded sensory panel capacity has been achieved with 20 new part-time dedicated sensory panellists recruited from the local community. The assessors have been used for smoke sensory assessments and quantitative descriptive analysis projects.

NMR LABORATORY

A new liquid state 400mHz nuclear magnetic resonance instrument was commissioned in 2020/2021. This platform provides high-throughput metabolite screening, structural elucidation and accurate quantitation of metabolites in biological samples.

NEW EQUIPMENT AND CAPABILITIES FOR WIC WINEMAKING SERVICES

A new bottling line was installed in the Hickinbotham Roseworthy Wine Research Laboratory, suitable for both conventional and research winemaking volumes. A new capability to conduct brewing and distillation trials (both small-batch and pilot-scale) has been launched.

STRATEGY DEVELOPMENT

A range of strategic planning activities were undertaken during the year. A management summit was held in March 2021 to develop a 2021-2023 version of *AWRI Directions*, the business and operational initiatives that guide the AWRI's continuous improvement. AWRI Commercial Services is developing a new strategic direction, which will support the sustainability of the AWRI into the future. A whole-of-business strategy is also under development.

LEADERSHIP DEVELOPMENT PROGRAM

During the year the AWRI introduced an internal Leadership Development Program. With an inaugural cohort of four staff from across the AWRI's operational groups, this program aims to provide high-performing staff who exhibit leadership potential with a range of practical experience, formal training and other opportunities for personal and professional growth.

REVIEW OF BOARD COMPOSITION AND APPOINTMENT

The AWRI Board commenced a review of its composition and Director appointment processes, seeking to ensure that it continues to apply best corporate governance practices which effectively balance skill representation, industry connection and various dimensions of diversity in the composition of its Board. Following a period of stakeholder consultation, the outcomes of this review are expected to be implemented in 2022.

COLLABORATION WITH THE UNIVERSITY OF ADELAIDE

The AWRI and the University of Adelaide developed a 'Friendship fund' for joint projects, focusing on opportunities with potential to further leverage an initial investment and 'grow the pie' for wine research on the Waite Campus. Initial projects funded under this arrangement span topics including Shiraz disease, grape and wine acids, smoke taint and consumer purchasing behaviour for no- and low-alcohol products.

STRATEGIC IT ACHIEVEMENTS

The remaining elements of the AWRI's current *IT Strategic Plan 2019-2021* were substantively delivered, including the enhancement of network capabilities, an expanded back-up program and a range of IT security enhancements. A replacement *IT Strategic Plan* is expected to be developed over the following year.

NEW MICROBE STRAINS CHARACTERISED

A number of strains with unusual fermentation properties were characterised by the AWRI Wine Microorganism Culture Collection with potential for use in wine production and other industries. These included a hybrid *Saccharomyces* yeast with high sorbitol fermentation potential, which may be useful in the pharmaceutical industry, and a yeast isolate that appears to ferment fructose but not glucose, which may be useful in low-alcohol beverage production.

RAPID SMOKE SCREENING TRIALLED

Initial trial work has been completed on the application of mid-infrared spectroscopy for screening potentially smoke-affected grape samples. This rapid method shows promise in identifying very clean or highly smoke-affected samples and could reduce the numbers of samples that need the more time-consuming mass spectrometric analysis, decreasing instrument congestion and getting results to clients more quickly.

Readers are encouraged to read the Annual Report in detail rather than relying on the brief details provided here. The full report can be found on the AWRI website: www.awri.com.au.

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PHOTOGRAPHY

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