

A partner in the Wine Innovation Cluster, SARDI offers unique scientific skills in viticulture science to underpin sustainable, profitable viticulture industries, thereby supporting the South Australian government's contribution towards national grape and wine industry objectives.

Core expertise supports the wine industry through capability in water, irrigation and salinity management, climate risk management, crop physiology, biosecurity and plant and soil health science.

Programs are client-focused to deliver directly applicable solutions and advanced technologies.

SARDI provides research leadership in:

- Viticulture crop production systems
- Water resource and irrigation - specialising in the root zone environment
- Climate applications and crop physiology
- Plant and Soil Health
- Biosecurity
- Technologies



Water and Irrigated Resources

The high level goal of SARDI's Water and Irrigated Resources program focuses on sustainable agricultural water management for South Australia. The team conducts research to support sustainable use of the State's water resources for irrigated horticulture and develops strategies to reduce the impact on the quality of surface and groundwater resources.

The science of water resources, soils, solute and nutrient transport associated with irrigation and agricultural land use is emerging as a major field in its own right and warrants specific focus. The water and irrigated resources program brings together a unique combination of plant agronomy and nutrition and environmental physics. It is also an area of

research that transcends program boundaries and developing this capability will bring larger collaborative opportunities both within SARDI and with external providers.

Root zone salinity

Maintaining soils productivity under increasingly intensive viticultural practices will be a high priority for industry. SARDI pioneered the science of regulated deficit irrigation for the Australian wine industry, however, the trade-off from applying highly efficient irrigation is the potential to build up of salinity within the root zone. SARDI has developed unique expertise in rootzone salinity management to help counteract the trend including monitoring tools and effective salt-leaching strategies. In concert with the Tri-State salinity team, tools and technologies are being road tested with irrigation communities in the Murray Darling Basin region where the impact of salinity is expected to be most severe. The SARDI viticulture rootzone environment focus aligns with the proposed direction of the Wine Industry Cluster partners. SARDI, collaborating with cluster partners and industry, is exploring unique technologies to improve soil physical conditions in both new and established vineyards through the use of recycled organic materials. These technologies will help grapegrowers reduce their irrigation requirement and make their vineyards more resilient to climate change.

Drought response

A key science program as part of the South Australian Government's drought response project is testing the extremes under which grapevines can survive when faced with extreme water deficits. Trials have been established by Yalumba Nurseries at Oxford Landing Estate and at an Orlando Wyndham vineyard in Langhorne Creek to gather information about the absolute minimum water needed to keep vines alive and grow commercial crops. If production has to be shut down, the research will provide information about how long it will take to restore yields and ensure vineyards are not lost as a critical asset. The project is subjecting vines to as little as 10% of the vineyards normal water usage for up to three irrigation seasons, and subsequently assessing recovery for up to four years. The research will measure irrigation volumes and salinity, ground water levels and salinity, soil moisture, grapevine canopy area, soil and plant salinity, plant water stress indicators, yield

and fruit and wine quality. These trials are continuing with industry backing through the Grape and Wine Research and Development Corporation and the field sites will be utilised by other WIC partners.



In conjunction with Yalumba the State Government has set up an extreme grapevine trial.

Viticulture staff are working closely with the Phylloxera and Grape Industry Boards of South Australia to help identify rootstocks that have improved drought tolerance for regions that are reliant on irrigation.

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Viticulture climate applications and crop physiology

Viticulture, climate and crop scientists work together focusing on the adaptation and management of water and temperature-stressed vines.

The program provides a comprehensive and innovative research platform aimed at improving the adaptive capacity and resilience towards environmental stresses. This imperative involves a significant partnership between government, industry and research organisations.

Climate risk refers to both season-to-season climate variability and longer-term climate change. South Australia as the driest state is vulnerable to both season-to-season variability and the longer term outlook is for hotter and drier conditions with more extreme weather due to climate change. Climate shift in the Murray Darling Basin has put current irrigation practices and businesses under pressure. Viticulture managers will need to deal with:

- Reduced water availability
- Reduced water quality
- Increased root zone salinity
- Higher temperature
- Higher atmospheric CO²

SARDI is well placed to tackle the issues in a coordinated approach, actively promoting interactions across its science disciplines to draw on the talents of innovative thinkers, further supported through partner agencies.

Although viticulture is exposed and sensitive to climate change, the grapevine is an adaptive plant. The climate applications team is working to explore the adaptive capacity at the vine, vineyard and winery level.

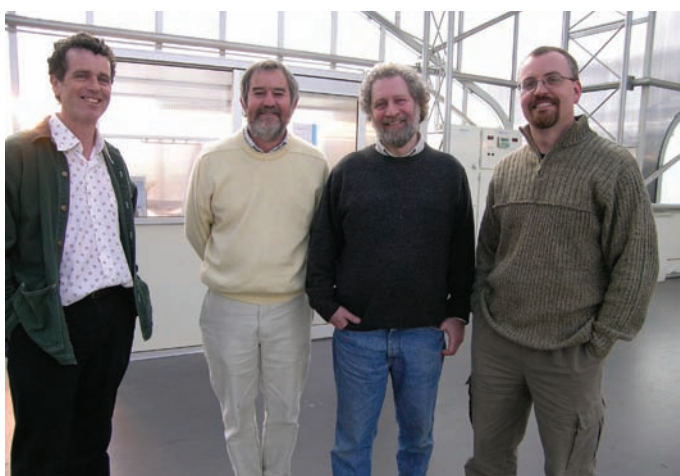
Currently the Grape and Wine Research and Development Corporation (GWRDC) is funding research investigating the impacts of the timing, intensity and duration of heat stress on the phenology, yield components and berry composition of Shiraz. For this, vines are tested at critical growing periods in state-of-the-art facilities that simulate heat stress under realistic field conditions. The research highlights the importance of understanding and managing the four-way interaction between heat stress, irrigation, canopy-fruit load and variety.

Temperature drives crop development. In collaborative research SARDI has completed a GWRDC-funded analysis of historical climate and vineyard records to model the effect of temperature on grapevine development and wine styles. The project has made a breakthrough in compiling the first scientific report documenting the actual rates of change in maturity associated with recent warming. For Shiraz, Cabernet Sauvignon and Chardonnay across Australia, maturity has advanced at rates between half and three days a year since 1996. The analysis indicates that each





degree change in temperature alters maturity by seven days. This has implications for the management of harvest operations. Technological improvements including better management of crops and improved wine making techniques have helped to maintain wine quality with varying regional responses identified. Knowledge arising from projects will provide a foundation for industry to adapt to climate change. However, with prolonged drought, there is now a need to accelerate, strengthen and add new dimensions to this research. New technologies such as advanced fertigation, subsurface irrigation and multiple irrigation systems will be needed to help plants cope with rising temperatures and reduced irrigation allocations.



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Plant and Soil Health

The Plant and Soil Health group offers high level capabilities in viticulture pathology and aims to underpin Australian viticulture industries by providing targeted research and development on plant pathology, disease management, biosecurity, soil health and diagnostics.

The group is leading national change in innovative and sustainable management of viticultural diseases. Research on foliar and trunk diseases is providing new understandings of disease management that are being readily adopted by grapegrowers. SARDI has considerable expertise in disease forecasting and in delivering new technology to industry. This is providing the Australian viticulture industry with market advantages from its improved production, decreased chemical inputs and reduced carbon footprint.

SARDI is providing national biosecurity research leadership through the Cooperative Research Centre for National Plant Biosecurity. This involves developing novel ways to eliminate disease outbreaks, while limiting the negative economic and social impacts on growers, regions and the economy. A key component of this is early disease detection, correct diagnosis of disease and pests, and an improved understanding of pathogen and pest biology. Current approaches for eradicating exotic pathogens are also being evaluated in collaborative projects with international specialists.

Expertise in vine soil health has been developed by the group, particularly with the impacts of partial root zone drying and the use of recycled water on vines.

SARDI provides a diagnostic capability on pests and diseases to the Australian viticulture industry as well as contract research in plant and soil health, facilitating more effective management of disease caused by plant pathogens.

SARDI Entomology provides expertise in insect taxonomy, ecology, biological control and molecular biology, which are applicable to the fields of biosecurity diagnostics and integrated pest management programs accessed by viticultural industries.

Molecular approaches are applied to better understand insect biology and provide a basis for developing novel tools for industry. Through a collaboration with the CSIRO Cybernose™ research cluster, SARDI entomology has worked on cell-free sensory tools for quantitative wine quality analysis.

Environmentally sound approaches to pest management that support product marketability are emphasised through integrated pest management. This usually entails applying knowledge about the

dynamic biology and ecology of the target pests species, and their associated parasites, predators and diseases to develop sustainable control options.

The group has specific knowledge in the management of major viticultural pests, including lightbrown apple moth (LBAM), mealybugs, eriophiid mites and weevils, and is researching the impacts of pesticides on beneficial organisms. SARDI is pioneering research which aims to achieve a closer integration of viticulture with surrounding natural landscapes to provide more effective ecosystem service benefits. Natural enemies can enrich the ecosystem contributing to the control of viticultural pests. However, the extended host-free period when vineyards are dormant means that to be effective, natural enemies of key pests such as LBAM, must recolonise vineyards each season. We are investigating the potential for flowering native vegetation to provide the shelter, food and alternative hosts needed by natural enemies, along with other benefits which contribute to weed suppression, mitigation of soil erosion and the conservation of endemic biodiversity. An important aspect of this approach is the development of links with NRM groups to deliver government-sponsored revegetation programs. We are also demonstrating significant improvements in the biological control of horticultural pests through the use of soil amendments, findings which may hold direct application to viticulture industries, and warrant further exploration.

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Technology

Effective vineyard spraying has become increasingly

critical as quality standards tighten. Correct application is essential for high quality grapes and reliable yields. SARDI has commercialised a revolutionary fan-forced spraying system combined with an improved approach known as distance-based calibration. This system targets sprays more effectively and efficiently. A complementary user-friendly spray drift and evaluation kit enables growers to implement measures to ensure excellent crop coverage and minimise drift. The spray products are licensed to Croplands Pty Ltd.



Dr Tapas Biswas and Geoff Furness

SARDI has recently licensed a portable, user-friendly tool designed to help irrigators meet the challenge of root zone salinity as they strive to achieve highly efficient water use. Left unchecked, root zone salinity could cost Riverland and Sunraysia industries more than \$100M. The product is marketed world-wide under the name of SoluSAMPLER and is being manufactured and distributed by Adelaide-based company, Sentek Sensor Technologies.

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Facilities

SARDI has laboratories, offices and access to extensive scientific and applied research resources through the Wine Innovation Cluster and Plant Research Centre at the world renowned agri-science precinct at the Waite Campus, Adelaide. Regional research nodes including Nuriootpa and Loxton Research Centres provide the necessary resources for field experimentation and connection to growers. SARDI is also a member of the Riverlink network of federal and state scientific agencies, located in four research stations throughout the Sunraysia-Riverland region, working together to improve research and development services provided to Australian horticultural industries.