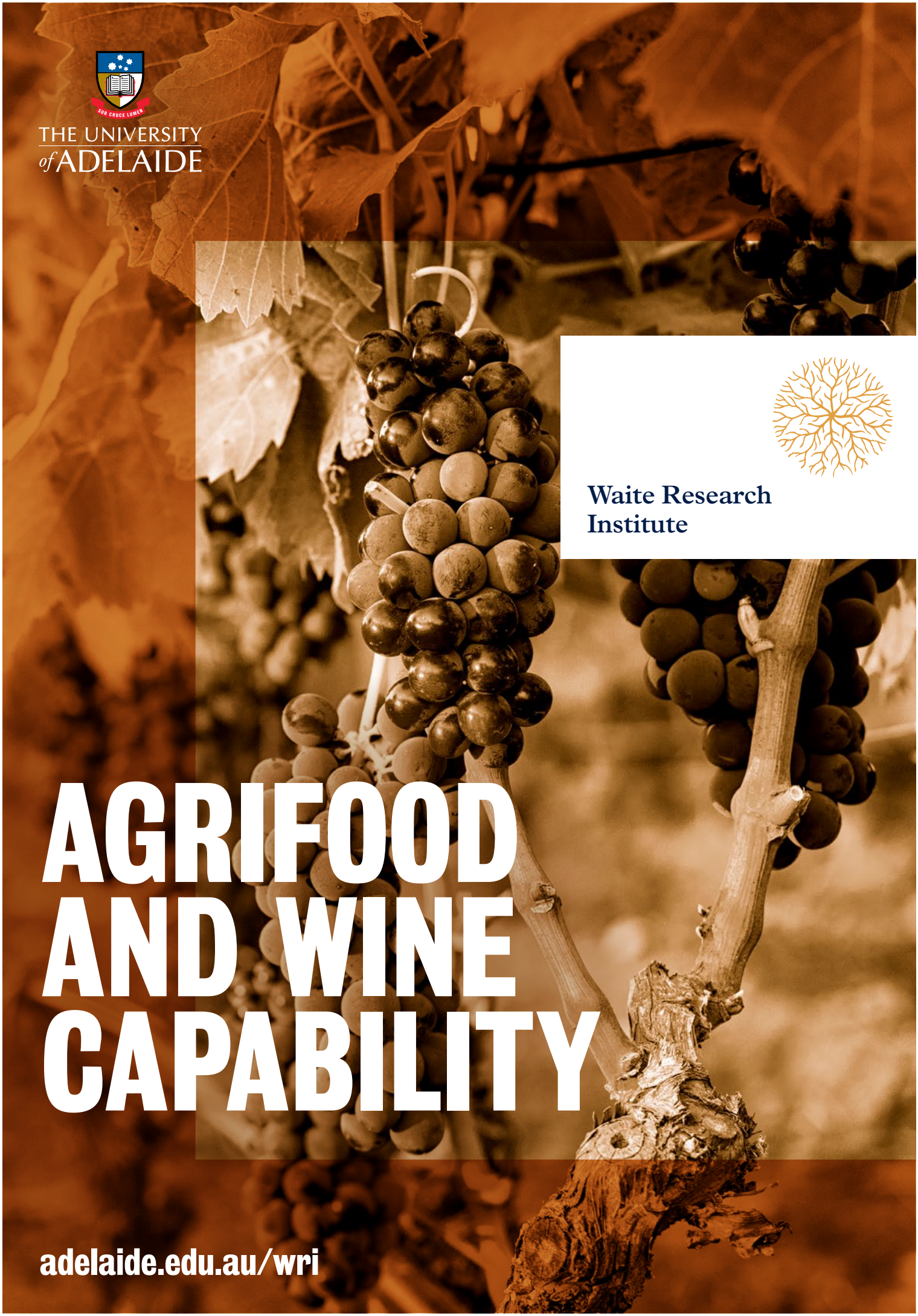

THE UNIVERSITY
of ADELAIDE
Waite Research
Institute
AGRIFOOD
AND WINE
CAPABILITY
adelaide.edu.au/wri

WELCOME

Agriculture and society face unprecedented challenges in the form of rapid climate change, land degradation, population growth and food security. The University of Adelaide is well placed as a leader to drive the next wave of innovation required to meet these challenges.

Through stimulating new activity and collaborations across a spectrum of research disciplines, the Waite Research Institute (WRI) is providing solutions to secure a sustainable future for Australian and global agriculture in close partnership with the agriculture, food and wine industry sectors.

Through a coordinated approach with partners, the University's researchers can bring their deep agricultural expertise together with new technologies, businesses and entrepreneurs to drive the future of global food production.

The research activities of the WRI include work that is applied and developed for impact, and cutting-edge fundamental research that will drive the innovations of the future.

Australian agriculture has always embraced science – our mission is to future-proof agriculture, and the WRI is our vehicle for driving innovation in this sector at this critical time for our planet.

Professor Peter Høj AC
Vice-Chancellor and President
The University of Adelaide

ABOUT THE INSTITUTE

The Waite Research Institute (WRI) is internationally recognised for its research, engagement and impact in agriculture, food and wine.

Our efforts in informing and supporting these sectors and their policymakers continue to provide benefit both to local consumers and communities worldwide.

Meeting global challenges

The WRI's broad vision is to drive innovation to secure a sustainable future for agriculture — by creating high-quality, nutritious and climate-resilient products.

To achieve our goals, we invest in outstanding researchers across multiple scientific disciplines, and provide them with advanced facilities to support both new strategic initiatives and established strengths. We create scale and focus in agriculture, food and wine research that translates into economic, social and environmental benefits.

WRI members have diverse expertise in agribusiness, animal and plant sciences, crop and pasture science, economics, engineering, food technology, social sciences and soils across the University of Adelaide's campuses at North Terrace, Roseworthy and Waite. Co-located industry partners and other research organisations add to the critical mass needed to perform transformational research.

We also put a strong emphasis on helping early-career researchers develop professionally and as leaders, through our Research Leadership Development program.

WRI AT A GLANCE

2018 Excellence in Research Australia (ERA) results

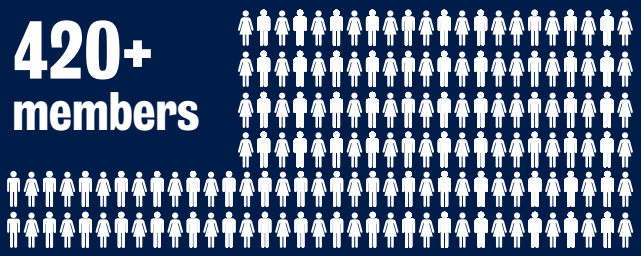
5 well above world standard:

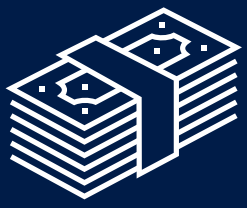
- Plant biology
- Agricultural and Veterinary Sciences

HIGH Engagement and Impact outcomes

- Agricultural and Veterinary Sciences

420+ members





$35M+ research funding (2020)

70%
70% of Australia's research capability in wine and grape science based at Waite precinct

16
co-located groups/centres/ organisations

06
new Australian almond varieties released since 2016

17
new barley, faba bean, durum wheat and bread wheat varieties released since 2014

450+
peer-reviewed journal articles annually

12
patents filed since 2014

18%
of all research outputs co-authored with research end-users (ERA 2018 assessment)

16
scientific disciplines represented

60
Research Leadership Development program graduates since 2011

MEET OUR DIRECTOR

Professor Matthew Gilliham

Matthew was appointed as Director of the WRI in June 2019 and has a track record of translating his fundamental discoveries to benefit agriculture. His work in improving salinity tolerance of crops is now used in breeding programs for wheat, grapevine and soybean.

With a PhD in Plant Science from the University of Cambridge, Matthew is a Web of Science Highly Cited researcher with over 20 years' experience in crop plant nutrition with a focus on drought and salinity tolerance, stress signalling and membrane transport.

In 2019, Professor Gilliham was appointed to the South Australian Premier's Science and Innovation Council, which provides advice to the State Government on supporting the strategic priorities and major advances in science and technology to drive the State's growth agenda.

RESEARCH WITH IMPACT

In a climate of limited natural resources, higher energy costs, increasing urbanisation, environmental degradation and market competition, the WRI's work in supporting food innovation and agricultural sustainability is critically important.

Our research is firmly focused on industry partnership and interdisciplinary exchange, enabling significant and productive ongoing interaction between external stakeholders and University of Adelaide researchers.

RESEARCH PRIORITIES

The WRI supports diverse research that delivers tangible outcomes and real-world impact. Our priority areas include:

Dryland agriculture:

- Drought resilience
- Sustainable farming landscapes and resilient environments
- Space and extreme environment agrifood and bioprocessing

Value-added agrifoods:

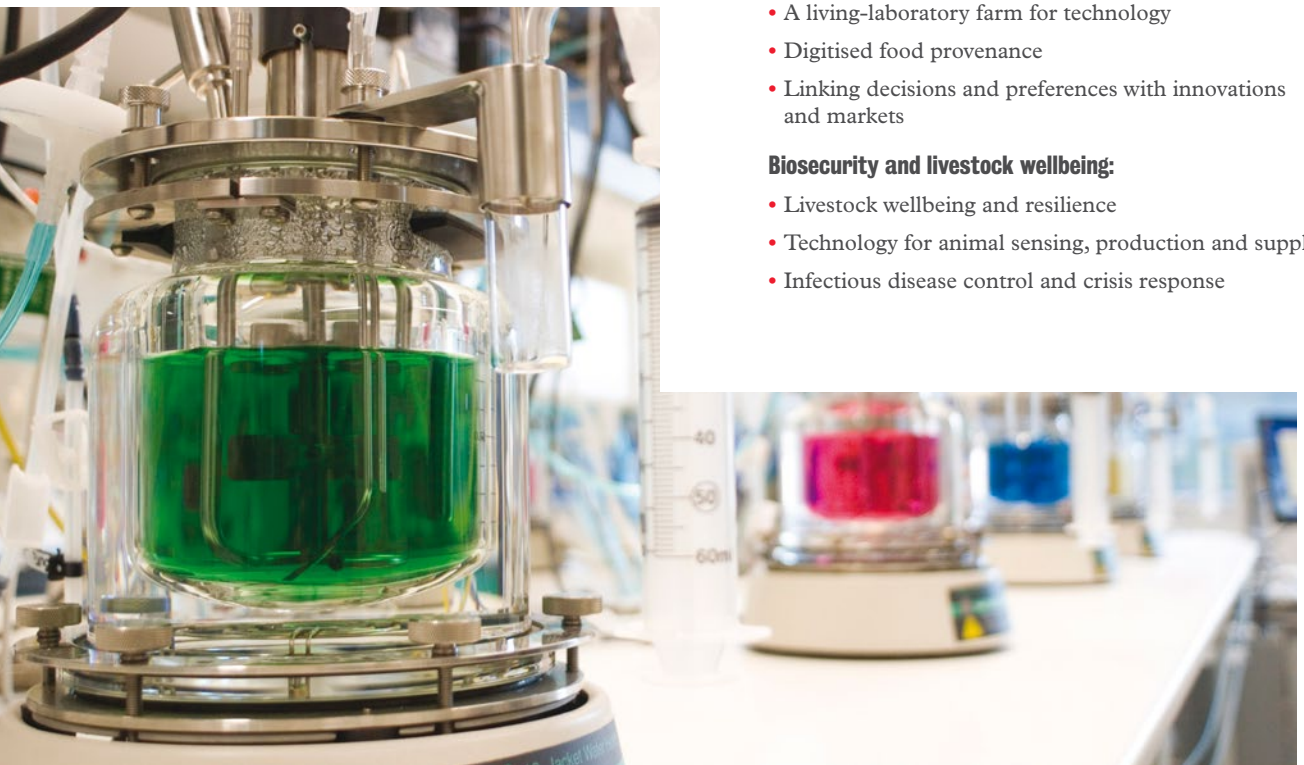
- From genomics to quality traits for plants and animals
- Protein innovation – new foods from new crops and bioprocesses
- New healthier foods and ingredients

Supporting the agrifood and wine value chain:

- A living-laboratory farm for technology
- Digitised food provenance
- Linking decisions and preferences with innovations and markets

Biosecurity and livestock wellbeing:

- Livestock wellbeing and resilience
- Technology for animal sensing, production and supply chains
- Infectious disease control and crisis response



RESEARCH CAPABILITIES

The WRI has a long-standing reputation for delivering outcomes that directly impact the Australian and global agricultural industries.

We have successfully established new, higher-yielding varieties of barley, durum wheat, oats, pulses, bread wheat, almond and grapevine rootstocks, with increased resistance to pests, diseases, droughts and soil salinity.

Our researchers work closely with the wine industry across the entire grape and wine research and development spectrum, including in consumer preferences, wine business and marketing.

We also have internationally recognised expertise in:

- agribusiness and consumer research
- agricultural science
- agronomy
- cereal bioinformatics
- controlled environment and field phenotyping
- crop abiotic stress tolerance, genomics and nutrition
- fertiliser design and development
- glycomics
- herbicide resistance
- ion transport
- livestock breeding and production
- plant breeding
- plant reproductive technologies
- sensory science
- soil biology
- wine and grape science

DELIVERING EXPERTISE ACROSS THE VALUE CHAIN

- Healthy grains and functional foods
- Livestock productivity and health
- Traceability, provenance and safety
- Transforming food waste
- International and market development
- Agriculture for space and extreme environments
- Novel crops and bioactives
- Wine and food science and technology
- Ag, hort and food tech
- Sustainable production landscapes
- Industry partnerships
- Teaching and training

EXPERTISE IN ACTION

High-value products from agricultural waste

With co-investment from the WRI, the Agricultural Product Development Research Consortium is a research-industry partnership to develop high-value products from agricultural waste. Some biomolecules that can be derived from South Australian crop waste show anti-oxidant, anti-inflammatory, anti-microbial, anti-cancer or gut-health properties; while others provide mechanical strength or texturising properties in food, structural materials, lubricants and cosmetics.

Projects include:

- anthocyanins from apples and cherries for use in skincare formulations and other health-promoting products;
- chitosan from mushrooms for use as a UV-blocker in both the skincare industry and as a coating for outdoor furniture and textiles;
- starch from potato waste which can be used for a range of commercial products such as nutraceuticals, pre-biotics and bioplastics;
- cellulose molecules from Brussels sprout stalk waste and other biomass as replacements for glass fibres in filtration systems and plastic materials.

Strengthening the Australian wine industry

Collaborative projects with industry are investigating how the environment, and stresses such as parasites, disease and drought, influence vine performance and productivity. Analytical chemistry techniques are employed to detect smoke taint in wine, examine consumer wine preferences, analyse flavour and aroma profiles, and give winemakers better information to ensure the quality of their product.

The University of Adelaide, with WRI support, hosts and leads the ARC Training Centre for Innovative Wine Production (TCIWP) to enhance innovation and global competitiveness in the Australian wine industry. Tackling modern and age-old challenges in wine production, the centre's multidisciplinary research team investigates aspects of viticultural management, oenology, wine chemistry and sensory science, and winery process optimisation.

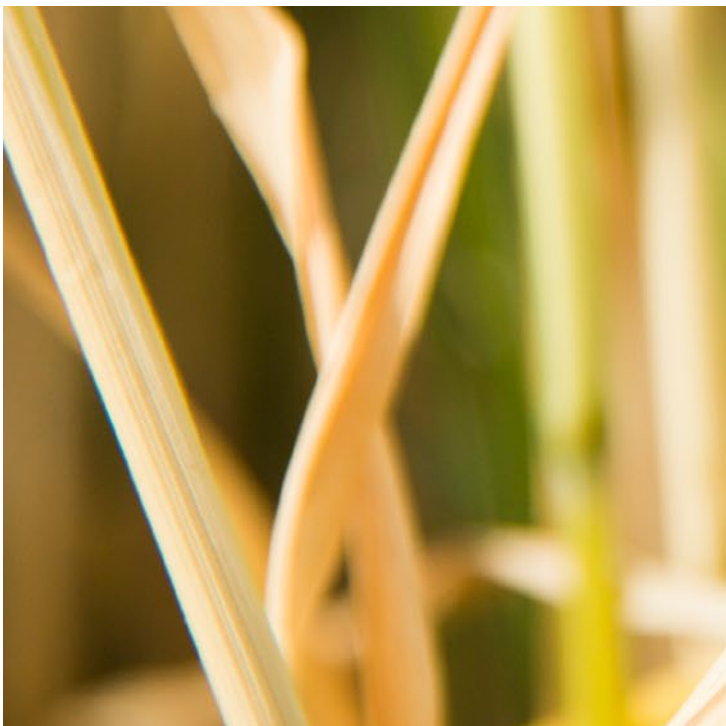
The Training Centre's multi-disciplinary team of researchers and industry partners have experience that spans the grape growing and wine processing value chain. Research projects are undertaken in conjunction with industry partners, providing students and post-doctoral researchers with valuable research training focused on end-user commercialisation and/or adoption of research and development outputs.

Drought resilience and sustainable production

WRI research on sustainable agricultural systems focuses on crop production and agronomy and is particularly relevant to dryland agricultural systems in Australia and overseas. This is complemented by long-established expertise in genetic modification and transformation technologies, and whole of pipeline capacity from plant breeding through to testing in controlled environments and then in large-scale field trials. International partnerships include research on biofortification, agroforestry and extension. Molecular genetics research from our initiatives in heat, drought and salt tolerance have been translated into breeding technologies that are widely applied in public and private cereal crop improvement programs around the world.

World-leading soil scientists work directly with industry and grower groups to investigate how soils respond to different nutrient levels, the impact of different soil moisture regimes on plant growth, and how fertilisers can be formulated to increase nutrient levels in food crops but minimise residues. The Fertiliser Technology Research Centre team design new fertiliser coatings that improve product storage and prevent caking and product breakdown. WRI research is also examining the role of soil ecological processes in supporting sustainable food production and land management and how biological fertilisers can be used to enhance crop productivity in an environmentally sustainable manner.

Led by the University of Adelaide as part of an extensive collaboration with industry and the South Australian Government, the SA Drought Hub undertakes research, development, extension, adoption and commercialisation activities to improve drought resilience and preparedness on SA farms. The Hub's activities are co-designed with industry and government partners, and delivered across regional nodes to demonstrate and increase adoption of drought resilience practices, implement social resilience and wellbeing strategies and leverage future investments for drought innovation and adoption initiatives.



Technology for efficient crop management

University of Adelaide research is improving vineyard management through the use of remote sensing technologies for identification of water and nutrient stress and the development of innovative digital tools for assessment of the severity and incidence of powdery mildew, or to help uncover the link between canopy size, yield and grape and wine quality.

Two new technologies for sensing crop water status have been developed by WRI researchers and are well-suited for automation of irrigation scheduling that can improve the water use efficiency of irrigated farms. These include an advanced sensing device on a microchip that can be embedded in plants to measure water potential in near-real time, and a low cost turnkey system that continuously measures crop water status indirectly via canopy temperature.

Imaging technology using terahertz waves has been used by WRI researchers to successfully and non-destructively screen barley plants for frost damage. Frost is estimated to cost Australian grain growers $360 million in direct and indirect losses every year. This technology could be developed into a field-based tool, which could be used by growers and agronomists to assist with their crop management and help minimise losses due to frost.

The Adelaide node of the Australian Plant Phenomics Facility (APPF) at the Waite campus has developed world-leading, internationally recognised technologies and expertise that provide an attractive partner for international collaboration. The Plant Accelerator provides the full spectrum of modern growth facilities, from temperature controlled greenhouses through to state-of-the-art, automated, high-throughput and deep phenotyping technology in large-scale Smarthouses. The APPF capability also incorporates DroughtSpotter platforms to support precision heat and drought screenings, and field phenotyping services using drone-mounted imaging and the ground-based FieldExplorer platform to non-destructively measure plant traits such as biomass and stress tolerance in field trials.

WE PARTNER WITH THE BEEF, SHEEP, PORK AND POULTRY INDUSTRIES TO DELIVER EVIDENCE-BASED RESEARCH OUTCOMES.

Livestock production and health

The School of Animal and Veterinary Sciences based at Roseworthy campus has international leaders who explore broad areas of research including animal behaviour, biology, population health, infectious diseases, reproduction, livestock and equine health. This research environment fosters research collaborations with local, national and international organisations and institutions. We partner with the beef, sheep, pork and poultry industries to deliver evidence-based research outcomes.

The Davies Research Centre is carrying out world class research, knowledge transfer and delivery of applications to build sustainability of the red meat industries. Ruminant animal experts explore the interactions between genetics, physiology, management and the natural environment to improve animal productivity, welfare and the quality of food for consumers.

The University of Adelaide's Australian Centre for Antimicrobial Resistance and Ecology (ACARE) has partnered with Meat and Livestock Australia, Australian Eggs, AgriFutures, Australian Pork Limited and Bayer to conduct evidence-based research on the effects of antimicrobial resistance in animals, and its impact on human health. ACARE has determined that Australian livestock products are among the safest in the world in terms of the risk of antimicrobial resistance entering the food chain.

New Foods for new Frontiers

The ability to produce fresh, nutritious food in space is critical to enable long-term exploration missions. WRI researchers are re-imagining plant design, growth, and processing to optimise nutrient-rich food and bioresource production, with minimal inputs and zero waste. These products are designed to support Moon-to-Mars exploration, but will have translatable on-Earth benefits to bolster Australia's agri-economy and support the sustainability of food production.

Market development and consumer research

WRI members have internationally recognised expertise in understanding food value chains and consumer behaviour. This allows us to extract the greatest value from all market segments and to carry out independent research to examine the factors that lead to greater levels of acceptance among communities and consumers regarding production practices and the use of science and technologies in the production of foods.

Research at the University of Adelaide is revealing critical consumer and alternative production insights to guide Australian winemakers in the search for increased sales and new markets.

The Centre for Global Food and Resources examines the impact of changing food markets and environments on consumption and diet-related health; determines the role of the private versus public sector in establishing food safety and food quality standards and governance in the food chain; examines the impacts of food labelling; and examines the welfare implications of policy alternatives.

The Food Values Research Group uses qualitative research methods to explore issues related to food ethics, such as animal welfare, free-range, and genetic modification. With countless factors – including many ethical – influencing modern-day Australians' food choices, ongoing research into how and why we reach our decisions is providing invaluable intelligence for local food producers and policymakers.

Collectively these activities are complementary to our food innovation teams who are designing new food products for improved health outcomes and to service new markets.

INNOVATIONS IN PLAY

Food crops: driving Australian producers' competitive advantage

In collaboration with industry, plant breeding programs at the Waite campus have produced over half the commercially grown grain varieties in southern Australia.

Since 2002, University of Adelaide plant breeding has led to the release of 25 new cereal crop varieties, which together have contributed to the production of more than $7.6 billion worth of grain from 2011 to 2020. For example, barley varieties combining high yields with superior quality supported national grains-industry profitability, and provided new options for domestic and international grain and malt buyers. Upstream 'pre-breeding' research also generated new materials and technologies (DNA markers and statistical methods) for application in commercial breeding programs, improving the cereal breeding industry's genetic gain and efficiency.

Durum wheat for better pasta

The durum wheat industry contributes in excess of $100 million per annum to South Australia's economy. Through our work with Durum Breeding Australia, the University has partnered with significant industry stakeholders, including San Remo Macaroni Company Pty. Ltd. and the Southern Australia Durum Growers Association. Collectively, we have developed durum (pasta) wheat varieties combining broad adaptation, enhanced yield potential, and premium quality production of this high-value crop, thus enabling the durum and pasta industries to thrive in southern Australia.

The industry's growth and success has been underpinned by these excellent working relationships, and has led to the development of resilient new durum wheat varieties, such as DBA-Aurora, to satisfy growing markets for high-quality pasta, couscous and other food products.

Healthy grains and functional foods

Dietary fibre, both the amount and type, is an important area of food science research. New complex carbohydrates have been discovered by our scientists and current research includes selecting wheat and barley varieties rich in dietary fibre, and developing chia and psyllium as valuable dietary supplements, and functional food ingredients to help promote healthy digestion.

University of Adelaide research has worked at the intersection of agriculture, food and human health – for example, developing low glycaemic index (GI) breakfast foods from a high-amylose wheat developed at the Waite Campus; high-lutein wheat for production of nutritious yellow alkaline noodles popular throughout South East Asia, China and Japan, without the need for additives; and studying the relationships between nutrition in pregnancy and infant development.

OMEGA-3 EGGS

WRI-supported research underpins an exciting—and very healthy—commercial collaboration between the University of Adelaide and South Australian egg producer Solar Eggs.

The institute's work revealed that flaxseed oil contains high levels of a short-chain omega-3 fatty acid. When chickens' diets contain the oil, their eggs are enriched with a long-chain omega-3 polyunsaturated fatty acid.

Solar Eggs is now using this knowledge to produce eggs with five times the omega-3 of a regular egg, and the enhanced product was launched in Drakes Foodland supermarkets in August 2018.

IN COLLABORATION WITH INDUSTRY, PLANT BREEDING PROGRAMS AT THE WAITE CAMPUS HAVE PRODUCED OVER HALF THE COMMERCIALLY GROWN GRAIN VARIETIES IN SOUTHERN AUSTRALIA.

Premium gluten-free baked goods

Gluten-free bread products are often considered inferior to regular bread in texture and taste. But a research partnership between the WRI and Riviera Bakery sought to change this.

The collaboration has produced a range of gluten-free breads with quality and consumer acceptance comparable to that of regular bread. The new recipes even feature enhanced nutritional qualities for health and wellbeing. Five recipes were developed and trialled, and two are now available for purchase in supermarkets under Riviera's 'Swiss Natural' brand.

BREEDING SUPERIOR ALMONDS

After the United States, Australia is the second-largest producer of almonds worldwide—and the WRI is working to help local farmers maintain that strong market position. The Waite-based Australian Almond Breeding Program has enjoyed a long-term and highly successful collaboration with industry, developing new high-yield varieties of almonds for commercial production in Australia to cater to changing environmental conditions.

Since 2013, six new varieties have been released—Maxima, Capella, Rhea, Carina, Mira and Vela. Each variety's yield beats the previous benchmark, Nonpareil, by at least 10 per cent. Four are self-fertile so are not reliant on bees and other insects for pollination.

NEW CROPS FOR THE AUSTRALIAN ENVIRONMENT

Through partnerships with industry, University of Adelaide researchers are working to identify and establish a range of new commercial crops that are better suited to the Australian climate. For example, a breeding program is being established for *Plantago ovata* in Australia to provide a reliable supply of high quality, superior psyllium as a key ingredient in the gluten-free food industry, providing benefits to the industrial partner, growers in Australia and consumers. Several varieties of sweet sorghum and industrial hemp are being investigated for growth characteristics, fibre and nutritional quality, soil and water usage, with potential to provide valuable multi-purpose crops for South Australia. Another project is partnering with national and international companies to establish Agave as a sustainable, versatile and climate-proof Australian crop, supporting production of a new high-value spirit for domestic and global markets.

Fertiliser for better yield and reduced environmental impact

With WRI support, the Fertiliser Technology Research Centre focuses on the fundamental processes controlling fertiliser efficiency in a wide range of soils globally. The Mosaic Company, the world's largest provider of potash and phosphate fertilisers, has been a major industry partner since the centre's establishment in 2007. This collaboration has led to numerous international patents on new fertiliser technologies resulting in real impact through increased crop yields for growers worldwide.

Research is focused around developing fertilisers with enhanced spreading and handling qualities, and pairing fertilisers with plant traits, bio-stimulants and microbial technologies for enhanced agronomic efficiency and minimised environmental impacts.

Biometry and machine learning applications

The WRI's statistics and data science expertise is strengthening and enhancing national and regional grains research outcomes through provision of statistical methodology to grains research projects in the region, and capacity building in experimental design and analysis skills. Application of machine learning expertise to genomic selection in plant breeding, and cutting-edge plant imaging technologies to improve accuracy and impact of measuring plant traits in controlled environments and the field, are helping develop plants that provide better yield in poor environmental conditions.

Australian Institute for Machine Learning

The University of Adelaide's Australian Institute for Machine Learning (AIML) is the largest machine learning and computer vision group in the nation-and a key WRI collaborator.

AIML has over 100 members and boasts outstanding research expertise, state-of-the-art facilities and global recognition.

The institute's specialised staff are highly experienced in tailoring R&D proposals to help organisations better compete in an AI-enabled economy.

Key areas of focus

AIML's talented researchers can work with you to provide practical solutions in areas such as:

- identifying patterns in large, complex data sources
- predicting future behaviour of people and systems
- optimising complex systems
- automating the interpretation of video and imagery
- producing computer vision and robotics application
- natural language processing
- visual question answering
- AI innovation strategies.

BETTER BARLEY FOR MALTING AND BREWING

Barley is worth around $600M to our local economy and the majority is exported for use in the international malting and brewing sector. Research combining WRI expertise in cereal growth and development with the University's chemical engineering capability is helping growers sustainably produce more barley of a higher quality and that can attract a premium price tag. Understanding the chemical compounds that contribute to beer flavour to satisfy both domestic and international markets is a research priority for industry partners.

In 2020, French barley breeding company SECOBRA released its first variety in Australia after many years of collaborative research and development with the University of Adelaide. Laperouse (tested as WI4952) is a new barley variety bred at the Waite, with research investment from GRDC and developed by SECOBRA Recherches' Australian breeding program. Australian Grain Technologies has also released their first barley variety, Beast (tested as AGTB0113) developed from the University of Adelaide's advanced barley germplasm pool.

OUR PARTNERS

HOW WE CAN HELP

At the WRI we're highly experienced in building Australia's capability and competitiveness in agriculture, food and wine through collaboration.

In partnership with government and industry, we regularly tackle significant, global issues. We identify and understand market opportunities, both domestically and internationally; and we help partners translate our findings into high-value new products and services with real commercial impact.

If you're ready to take that path, don't hesitate.

CONTACT US

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KAURNA ACKNOWLEDGEMENT

We acknowledge and pay our respects to the Kaurna people, the original custodians of the Adelaide Plains and the land on which the University of Adelaide's campuses at North Terrace, Waite, and Roseworthy are built. We acknowledge the deep feelings of attachment and relationship of the Kaurna people to country and we respect and value their past, present and ongoing connection to the land and cultural beliefs. The University continues to develop respectful and reciprocal relationships with all Indigenous peoples in Australia, and with other Indigenous peoples throughout the world.

FOR FURTHER ENQUIRIES

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Published July 2021 UA30092-IL
CRICOS 00123M

SOUTH AUSTRALIA