Facilities

Laboratories

Charles Sturt University has more than 25 operational laboratories ranging from standard through to physical containment level 3 (PC3). They are certified for work with Genetically Modified Organisms (GMO) and designed to be accredited as Quarantine Approved Premises (QAP). The university laboratory facilities include large bench space laboratories, preparation and wash up facilities, liquid nitrogen storage and dispensing area and specialist rooms for microbiology, microscopy, molecular biology, parasitology, tissue culture and virology.

Analytical equipment

Charles Sturt's analytical capability encompasses a range of specialist equipment including the only Supercritical Fluid Extractor in Australia. Other specialist equipment includes High Performance Liquid Chromatography (HPLC), Gas Chromatography – Mass Spectrometry (GCMS, GCMQTOF) and Liquid Chromatography – Mass Spectrometry (LCMS, LCMWQTOF, LCMSQQQ). Microscopy capability includes scanning electron, fluorescent, light, confocal and slide scanner.

Phytotron and growth chambers

Charles Sturt's phytotron is a large, open plan space with areas for working with plants and soils including dehydrators, plant and soil grinding rooms, cold rooms, dry storage area, vacuum digging equipment, and soil sterilisation and root washing facilities. Housed within the phytotron are the university's 13 large growth chambers, including two specialist chambers for frost conditions and CO2. The growth chambers are temperature, light and humidity controlled to provide the perfect environment for plant and soil testing.

Research winery and vineyard

Charles Sturt's Research Winery enables the production of red and white wines with state-of-the-art wine making equipment and temperature-controlled fermentation for replicated small batches of 1L to semi-commercial production of up to 1,000L. There is also a one-hectare experimental vineyard.

Sensory and consumer sciences

Charles Sturt's Sensory Laboratory has a fully equipped kitchen and sample preparation area suitable for wine and food evaluation, a 12-booth sensory analysis suite with pass-through compartments for distribution of samples to participants and computer assisted data collection and sensory evaluation software.

Partnerships

We want our research to make a difference. That's why we work closely with industry, increasing the adoption of our research outcomes. We also work in collaboration with a range of Australian research institutions and universities along with commercial vineyards and wineries.

The NWGIC has a number of international collaborations to support our research and PhD student training such as VINIFERA Euromaster and OENOVITI, and with research providers including universities in Europe, North America and South Africa.

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Charles Sturt University
GRAHAM CENTRE for Agricultural Innovation
NATIONAL Wine & Grape INDUSTRY CENTRE

Leading viticulture, wine science and horticulture research

Leading viticulture, wine science and horticulture research

Charles Sturt University research is focused on improving the profitability and sustainability of Australia's food and wine sectors.

Multidisciplinary research teams from the National Wine and Grape Industry Centre (NWGIC) and the Graham Centre for Agricultural Innovation work closely with industry partners to deliver solutions throughout the value chain.

World-class research

Our research has been ranked the highest rating of five – 'well above world standard' – for horticulture production in the Australian Research Council's (ARC) Excellence in Research for Australia (ERA) outcomes for 2015 and 2018.

The ERA assessments are conducted by a rigorous examination of outputs by independent assessors to measure the quality of research produced by Australian universities against world standards.

Our research 'Harnessing ecological expertise to develop novel pest management approaches' was also listed in the impact case studies in the ARC Engagement and Impact Assessment 2018–19 National Report.

Our expertise

Charles Sturt is committed to excellence, integrity and sustainability in research. We're experts in applied ecology, molecular biology, plant pathology, vine physiology, analytical chemistry, chemometrics, metabolomics, consumer and sensory science, artificial intelligence and machine learning.

Current research areas

Vine health and disease management

- Diagnostics
- Pest and disease management
- Grapevine trunk diseases
- Bunch rots and wine quality

Vine sciences

- Vine physiology and nutrition
- Root functioning
- Flowering and berry growth
- Water use components in the vineyard

Wine sciences

- Fruit and wine composition
- Process engineering

Sensory and consumer sciences

- Wine styles
- Understanding consumer perceptions to develop new sorghum markets

Applied ecology research

- Ecological tactics to reduce vegetable crop losses
- Integrated pest and disease management
- Evaluating the ecosystem services of dung beetles
- Cost benefit analysis of ecological pest management techniques

Research success

Water balance and drought resilience: a pilot study in vineyards in Orange NSW

Water availability is set to become a bigger challenge for Australian viticulture and horticulture with predictions for more frequent and severe droughts, drier winters, and a long-term decline in annual rainfall.

Key to tackling these challenges will be reducing reliance on irrigation and using available irrigation water strategically.

This means adjusting management practices to reduce the difference between water demand and supply.

This research characterises plant water efficacy in relation to different soil types, canopies and climate.

It's also examining how changes in the whole vineyard management system will allow productivity to be maintained when there is limited water availability.

Vineyards from different altitudes and soil types in the Orange district of NSW are being studied to quantify water use components throughout the season.

Of particular interest is the contribution of the deeper part of the root system to overall water requirements, and to compare estimates of total soil water available with those calculated from soil properties.

Researchers are monitoring soil moisture down to 1.6 metres. Sap flow gauges are also used to directly measure vine water use. This will be compared with values calculated from weather data, rainfall and any irrigation inputs.

Grapevine trunk disease management for vineyard longevity

Charles Sturt research is contributing to our understanding of grapevine trunk diseases leading to better management strategies for growers.

Grapevine trunk diseases are caused by fungi that infect vines through pruning wounds colonising the wood, causing dieback, yield losses and eventually killing the vine.

DNA-based molecular tools are being used to detect and quantify spores of Eutypa dieback and Botryosphaeria dieback pathogens in vineyards.

The research is investigating the dispersal of the fungal spores throughout the year and how long pruned wood is susceptible to infection.

The valuable information gained has provided vineyard managers with recommendations to minimise the spread of pathogens.

For example, avoiding pruning in wet weather because rainfall is the primary factor triggering spore release.

Wound protection treatments and trials of remedial surgery to rejuvenate vines have been shown to be cost effective treatments for managing infected vines.

This research is part of a collaborative project with the South Australian Research and Development Institute (SARDI).

The knowledge gained from studying wood diseases in grapevines is now being used to solve similar wood and dieback disease issues for the walnut industry.

Understanding the regional typicality of Shiraz

Charles Sturt research has examined the correlations between the sensory properties of Australian Shiraz wines, their chemical profiles and the climatic regions from which the grapes were sourced.

The notion of terroir means that wines or other agricultural products from a particular region are unique, with distinct flavour characteristics resulting from a range of environmental, cultural and human contributions.

Defining a terroir influence will allow Australian fine wine producers to substantiate uniqueness claims to command premium prices in a global context – this project has shown that this is possible.

It brought together experts in spatial and climate science, wine production, sensory science, chemometrics, metabolomics and data sciences.

Shiraz wines from six Australian regions covering a range of climatic conditions, including Barossa, Canberra, Heathcote, Hunter Valley, McLaren Vale and Yarra Valley, were selected for the project.

The wines were firstly classified according to their sensory composition, and a number of sensory features characteristic of particular regions were identified. Using a range of targeted and untargeted chemical analyses, this research also found Shiraz wines have chemical 'fingerprints' that are specific to their region and that some individual markers of terroir could be recognised.

The metabolomic profiling approach utilised has the potential to be adapted to a diverse range of other agricultural products.

Image analysis to assess and manage plant nutrient disorders

The value of multidisciplinary research is shown in a project to develop a new smartphone app to identify nutrient disorders in the vineyard.

Viticulture scientists are working with experts in Artificial Intelligence (AI) and machine learning.

They've created an image library of symptoms by growing vines in solutions that have either too much or too little of a particular nutrient.

These images of Mg, K, Fe, N deficiency and for B toxicity in vines are being used to develop and train the algorithms that perform the diagnosis.

A grower will be able to walk along the row of grapes and take images of the disorder with a smart phone.

The app will then use underlying AI to immediately diagnose the problem and provide links to fact sheets and other information sources on how to best deal with the issue.

The app will be used by grape growers in conjunction with petiole tissue sampling to rapidly diagnose nutrient disorders.

Ecological approaches to pest and disease management

Charles Sturt has more than a decade of research using ecological tactics to reduce pest and disease losses in a variety of crops including rice, cotton, vegetables and pine plantations.

We've found that perennial native vegetation is a major source of beneficial insects that boost biocontrol of crop pests. This research has changed attitudes to non-crop vegetation in the cotton industry.

Another project helped the $22 billion Australian pine industry combat the threat of an exotic bark beetle, the sirex wood wasp.

A new project, funded by Hort Innovation, is providing vegetable growers with additional tactics for use in their integrated pest management (IPM) strategies. Where perennial vegetation is lacking, farmers can use strips of annual plants to attract beneficial insects.

Field trials in four states have shown growing flowering plants like sweet alyssum, buckwheat, and cornflowers amongst the Brassica vegetable crops led to more beneficial insects and lower levels of damaging insects. This approach has attractive benefit: cost ratios.

We're working with collaborators to deliver similar benefits in Africa, East Asia and Papua New Guinea. This research is expanding to simultaneously deliver ecosystem services (such as pollination, nutrient cycling, and on-farm biodiversity conservation) in ways that are simple, cost-effective and fit readily with mainstream farming.