



Germplasm Gaps Analysis

The *GWRDC Strategic RD&E Plan 2012–17* identifies the development and evaluation of grapevine, yeast and bacterial germplasm as a priority for the Australian wine sector.

Background

Enhancing the value proposition for consumers requires a new and improved set of planting material, processing aids and tools and evolution of practices by the wine sector. The focus on environmental stewardship and sustainability will need to go hand-in-hand with these developments.

Grapevine germplasm is the foundation of the Australian wine sector. Planting decisions require high-quality material that is resilient to future climate challenges while being able to deliver desired wine quality and styles. Theme 1.2 of the *GWRDC Strategic RD&E Plan 2012–17* (Strategic Plan) focuses on developing, evaluating and identifying rootstocks, varieties and clones that produce desirable wine styles, while possessing a number of other essential properties such as tolerance to drought, heat, salt, soil-borne pests and diseases.

Fit-for-purpose yeast and bacterial germplasm are also a key ingredient in the efficient production of superior wine at a range of price points. Theme 3.2 of the Strategic Plan focuses on developing and evaluating new and enhanced fit-for-purpose yeast and bacterial germplasm.

For both these themes, conventional breeding will be accelerated using genetic techniques and biotechnology. Both these themes complement and interact strongly with Program 2 *Consumers and markets* and themes 3.1 *Objective measures of quality and assessment systems* and 3.3 *Process efficiency*.

Situation analysis

GWRDC commissioned Di Davidson, Davidson Viticultural Consulting Services, and Mark Gishen, Gishen Consulting, to review current knowledge in this area and to identify industry needs for grapevine germplasm and yeast and bacterial germplasm respectively. A summary from each author is provided below.

Grapevine germplasm

Di Davidson

The outcomes of a study of the wine industry's current view of the status and gaps in grapevine germplasm knowledge and research is summarised here. The information was gathered by speaking with about thirty experienced industry personnel, both by telephone and in person; casual discussions were also held with a number of winegrape growers.

The individuals included senior executives of the major winemaking companies, highly experienced viticulturists, representatives of some regional organisations and active members of the nursery and vine improvement sector.

Past and current germplasm projects were discussed and views sought on the relevance of current work and any perceived gaps that might limit their choice of germplasm over the next ten years.

This process provided the basis for identifying some gaps and opportunities that may be used to assist the GWRDC in planning future research investments in this area. The findings are summarised below:

The case for investment

The current level of investment by the GWRDC in germplasm research represents about 7% of its total investment across the entire wine industry. The personnel interviewed were all cognisant of the research work, but not all were across the detail.

All were very supportive of ongoing investment in this area, but there were few very specific recommendations to fill any gaps. There was an appreciation of the ongoing, and long-term, nature of some of the current research, and the general comment was that the industry must continue funding it. However, it appeared that the scope, limitations and deliverables from some of the work are not well understood. There is an opportunity to communicate this better.

Current situation

The industry appears to be very supportive of the continuation of all the current rootstock work, as well as the research aimed at reducing susceptibility of mainstream varieties to fungal pathogens given the high economic and environmental costs associated with this fungal control.

There seems to be less support for the concept of breeding new, Australian, varieties, which are perceived by a few as being of low value. But while there was an overwhelming request for continued work on mainstream varieties, the historical base of the Australian industry, there was recognition that discontinuation of the breeding of new varietal material would be short-sighted. None of the wine companies expressed interest in using any such material in the next ten years.

Although people placed different weight on the different projects, reflecting their own particular interest or knowledge, most felt that there were no immediate gaps, implying that most if not all of the current work should continue.

Gaps and opportunities

A range of gaps in knowledge were identified and grouped under three broad headings:

1. Rootstocks

- Greater focus on heat tolerance, as well as drought tolerance.
- Stepped up work on water use efficiency.
- Evaluation of rootstocks in more regions, especially the cooler regions.

2. New traits

Continued and, if possible, more work with marker assisted selection, to incorporate disease resistance traits is strongly supported. The economic costs of fungicide use, especially with chemical resistance occurring, are crippling the grape production sector, and the environmental costs are of growing concern.

3. Current varieties

There was a clarion call for more clonal research and evaluation. While most interviewees recognised the relatively limited genetic pool available within clonal work, there is a real demand for evaluation, assessment and release of a much wider ranges of clones, as one means of broadening opportunities within mainstream varieties.

Yeast and bacterial germplasm

Mark Gishen

The results of an investigation about the status and gaps of yeast and bacterial germplasm knowledge and research are summarised here. The information was gathered through a combination of activities including:

- A review of past and current outputs and outcomes of GWRDC projects
- Investigation of industry needs and capabilities through interviews with selected stakeholders.

These activities provided the basis for identifying gaps and opportunities, which may be used to assist the GWRDC in planning future research investments in this area. The findings are summarised in three main headings below.

The case for investment

Winemakers have a growing interest and demand for increased diversity of yeast and bacterial strains, to increase efficiency and to optimise the options that may differentiate their wine products.

Current investment by GWRDC in yeast and bacterial germplasm research represents only about 10% of total investment. Previous research and extension has resulted in increased awareness of the value of exploiting germplasm in winemaking, with the outcome that a large and increasingly diverse range of commercial strains are available and are being used.

This investment has also uncovered a significant body of knowledge about the characteristics of yeast and bacterial strains, which has greatly enhanced winemakers' ability to manage problems when they occur. Nevertheless, a range of practical management problems remains unsolved in part or whole at present, and warrants further investment in research for solutions.

Current situation

While research over a long period of time in this field has clearly delivered many outputs and outcomes, there remains a perception by some winemakers that little progress has been made on the main problems of understanding fermentation reliability and nutrition/inhibition. Despite this perception, most winemakers feel that they can satisfactorily manage problems in practice when they arise, and recognise that researchers have contributed to providing that knowledge.

Winemakers rely heavily on technical information that is provided by suppliers, although some are wary about the objectivity. Most winemakers are quite cautious in adopting new strains, and on the basis of trials that they have conducted there are views that some of the novel strains are unreliable in one or several respects.

The industry appears to recognise the strength and value of the capacity and capability of research groups in the field, and recognise the contribution that these groups have made in driving innovation. Most winemakers interviewed were not aware of the existence or potential benefits of the culture collections held by the research groups.

Gaps and opportunities

A range of gaps in knowledge were identified and grouped under three broad headings:

1. Fermentation kinetics

- prediction of reliability
- impact of nutrients/inhibitors
- propensity to stick, lag phase
- interactions in mixed cultures
- measurement tools

2. Properties and by-products

- flocculation/suspension behaviour
- stability of performance;
- spoilage prevention
- positive- and off-flavour development

3. Other

- non-Saccharomyces yeast
- sanitation management
- wastewater microorganisms.

Some gaps in communication and extension were also identified, mainly in relation to providing objective information and better communicating the value and benefits of research outputs. The objectivity of information provided by researchers or suppliers can be perceived as compromised by commercialisation interests and might be better managed in future.

A range of traits of microorganisms that might be beneficial to winemakers has been identified and includes: lower alcohol efficiency, higher glycerol production, yeasts able to consume malic acid, yeasts and bacteria that are more tolerant to SO₂, high acid, or cold temperatures.

Trends in producing new styles of wine products will increasingly put a focus on the need to understand and manage potential spoilage microorganisms. Germplasm research may also be able to make a major contribution to the development of efficient ways to produce lower alcohol wines in future.

The research groups need to better protect the culture collections against risk of loss, and amalgamation with a larger collection might be one means to achieve better security.

New technologies offering the promise of potentially faster solutions to gaps will need to be matched in practice by researchers. Maintaining the capacity of researchers' skills base in informatics will become increasingly important with the adoption of emerging information-rich research technologies.

Next steps

GWRDC is looking for research proposals that address industry priorities and satisfy the following criteria:

- lead to industry relevant outcomes in a timely manner
- involve appropriate collaboration
- represent good value for money, including appropriate co-contribution
- are novel and feasible.

Key dates:

Preliminary project applications due **Friday 2 November 2012**

Final project applications (FPAs) invited in **mid-December 2012**

FPAs due Thursday **24 January 2013**

Applicants advised **late March 2013**

Contracts issued **from April 2013**