Varietal and clonal identification of grapevines

The AWRI helpdesk is contacted from time to time by producers asking about options for testing either the variety or the clone of grapevine material. In this column, AWRI Research Manager, Dr Anthony Borneman, answers questions about the latest scientific advances in this area.

What tests are available for identifying grapevine varieties?

Grapevine varieties were historically distinguished by ampelography, which uses physical characteristics such as the colour, shape and size of leaves, shoots and fruit to differentiate them. Accurate varietal assignment via ampelography is a highly technical skill, which limits its use and makes it subject to human errors. Since the early 1990s, however, it has been possible to use DNA fingerprinting to aid in the identification of grapevine varieties (Thomas and Scott 1993), with commercial providers (including Affinity Labs) offering testing services in Australia and around the world. These methods greatly reduce the risk of grapevine varieties being misidentified.

What is the genetic basis of grapevine clones?

Grapevines are propagated via cuttings, which means each plant is essentially a twin and is almost genetically identical to all other vines of that particular variety. Over time, a very small number of mutations occur on rare occasions, resulting in a very small amount of genetic variation within a variety. While the small number of mutations that occur during propagation of a variety generally do not produce a noticeable change in the characteristics of the vine, 'sports', which feature new characteristics, can and do appear on the rare occasions. A clone is produced when desirable traits are identified and propagation material is collected to preserve those traits in subsequent plantings. The new traits, and any mutations present, then become 'fixed' and this unique pattern of mutation is then passed on during subsequent propagation of that clonal material.

Can varietal testing distinguish between different clones?

Existing varietal genetic tests rely on the large degree of genetic variation that exists between varieties. However, the genetic variation between different clones is much smaller and therefore the type of DNA testing that differentiates grapevine varieties is unable to distinguish clones. Ampelography is also often unable to reliably distinguish most clones within a variety, due to their close similarities.

Are tests available to identify grapevine clones?

The AWRI has developed a world-first sequencing methodology that uses whole-genome sequencing to detect the rare mutations that uniquely define the clones within a variety. This technique has been successfully used to define clonal variation across grapevine varieties including Chardonnay (Roach *et al.* 2018, 2020) and Pinot Noir (Wine Australia 2022). This discovery is now in the process of being developed into a commercial service offering.

What is the process?

Very young leaves (ideally 5-6 leaves, ~2 cm in diameter) are needed to perform the test. These can be supplied either fresh or frozen. DNA is isolated from the leaves and then DNA sequencing is used to obtain the unique DNA fingerprint for the sample. The sample fingerprint is then compared to an extensive DNA database that has been developed by the AWRI in collaboration with grapevine germplasm suppliers and collections from around Australia. A match to a clone present in the database allows for clonal (and varietal) identity to be provided for the sample.

What could a clonal test be used for?

The primary application for the clonal testing framework is to provide confidence in the identification of Australian germplasm. Testing of mother vines as well as random samples for quality assurance will provide a robust framework to ensure that planting material is the clone that is expected based upon records. Given the emphasis of clonal choice in current winemaking practices, testing of established vineyards can provide assurance that plantings are the expected clone, valuable information that could be used prior to the sale of a vineyard or of fruit. Clonal testing could also be incorporated before and after the importation process for new grapevine material or during virus elimination to ensure that the clonal material is accurately tracked during the process.

Which varieties can be tested?

A DNA database is currently being developed that covers well over 500 clones from more than 25 varieties, including Shiraz, Merlot, Cabernet Sauvignon, Pinot (Noir, Gris, Blanc, Meunier), Chardonnay, Sauvignon Blanc and Riesling.

When will this test be available commercially?

The commercial test is currently in the beta development phase and it is expected that it will be available in the next six to twelve months.

AWRI helpdesk

The AWRI helpdesk provides a free-of-charge technical advice service to Australia's grapegrowers and winemakers. For further information about clonal identification or any other technical matter, contact the helpdesk on (08) 8313 6600 or helpdesk@awri.com.au

References

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Acknowledgement

This work was supported by Wine Australia, with levies from Australia's grapegrowers and winemakers and matching funding from the Australian Government and by Bioplatforms Australia. The AWRI is a member of the Wine Innovation Cluster in Adelaide, SA. Special thanks are given to all the industry collaborators who have provided grapevine samples for the clonal sequencing project. GW