Genomics sciences guarantees better results in the art of winemaking

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While the art of fine winemaking is a beautiful thing, winemakers are increasingly turning to the power of science to give them the tools they need to ensure a high quality pour each and every time.

Thanks to innovative new research funded by Genome Canada and Genome British Columbia, help is on the way.

The research will harness the power of genomics to unlock fundamental gene functions within grapevine and yeast cells, ultimately helping growers and winemakers to improve wine production techniques and enjoy valuable cost savings in an industry that has seen $4.2 billion in sales in Canada alone.

Dr. Steven Lund of UBC is one of the lead investigators on the $3.4 million project, entitled "Grape and Wine Genomics."

His work will focus on using genomics to identify protein biomarkers that will assist viticulturists to monitor how the vine and berries respond to natural and human-made environmental changes.

"Essentially, we are trying to put more advanced tools into the hands of producers," says Lund, who equates current knowledge of the berry to a bit of a black box.

Currently, growers monitor what is happening in the berry like measuring pH and sugar levels to estimate harvest date, but not until late

in the growth process. But there are currently no means to monitor the impact that management techniques such as fertilization, irrigation, and leaf thinning have on berry ripening and flavour development earlier in each season.

"All of these techniques affect flavour and amino acid composition, but growers have no idea how or why," says Lund. "That's where genomics comes in."

The ultimate goal? "A practical application - a handheld device, which will help growers monitor proteins in the vine or berry at any time during any given season to determine when specific management practices should be applied and, perhaps most importantly, to what degree," says Lund.

As such, Lund is collaborating with Dr. Paul Yager, Professor of Bioengineering at the University of Washington, whose team has created a portable device for detecting blood-borne pathogens. Yager will work with Lund to adapt his technology for use in the vineyard, directly on the vines.

But while high quality grapes are essential for a good glass, they are but one piece of the puzzle. The rest of the magic occurs during the winemaking process itself.

Dr. Hennie van Vuuren, the project's other lead investigator, is the Director of the UBC Wine Research Centre. His team, which includes scientists from the Max Planck Institute in Germany and Harvard University in the US, is studying the function of the Fermentation Stress Response genes in wine yeasts, which are added to the grape juice during the winemaking process and are essential for converting sugars into alcohol and flavour compounds.

Van Vuuren and his team are using advanced technologies to see how yeast cells adapt to the many stress conditions they encounter, such as osmotic pressure, nutrient limitation, and increasing ethanol.

"We have recently discovered that yeast cells adapt to wine making stress conditions by switching on 62 genes of unknown function," says van Vuuren. "Our objective is to discover function for each of these 62 genes, and in so doing, help winemakers to control their outcomes a little better."

Cost savings is another important issue. Winemakers waste a lot of money due to spoilage caused by yeasts that are essentially faulty and don't allow them to achieve a fully dry wine. "Residual sugars are acceptable in varieties such as Riesling, but in a Cabernet Sauvignon for example, they will ruin the batch," says van Vuuren, who also notes that the residual sugars can leave the wine susceptible to microbial spoilage.

The Grape and Wine Genomics project will also probe social science questions raised by the research.

Dr. David Laycock is part of a team of five political scientists from Simon Fraser University, who are studying the social, political and regulatory contexts for scientific innovation as they relate to the wine industry.

Their work will help the Canadian industry and regulatory bodies better understand public concerns regarding the use of genomics technologies in the production of wine and the general food industry, and will help guide the responsible introduction of genomic technologies over the long term.

"Canadian industry can learn lessons from other wine producing countries and their attitudes towards scientific innovation," says Dr.

Laycock. "The best science and government funding in the world can still run up against a brick wall if there isn't a receptive public environment and an intelligent regulatory framework."

"We are proud to support this innovative and valuable research, which positions BC and Canada as global leaders in genomic wine research," says Dr. Alan Winter, President and CEO of Genome BC. "The knowledge that this team will generate will benefit wine producing countries around the world."

Source: Genome BC