THE UNIVERSITY of ADELAIDE

Australian Government
Australian Grape and Wine Authority

Macrowine 2014
Macromolecules and secondary metabolites of grapevine and wine
7-10 September 2014, Stellenbosch, South Africa



FINAL REPORT to
AUSTRALIAN GRAPE AND WINE AUTHORITY

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Principal Investigator: Jun Niimi
Research Organisation: The University of Adelaide
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Abstract:

Macrowine 2014 conference was held in Stellenbosch, South Africa from 7-10 September, 2014. Approximately 150 international delegates attended the conference.

The conference covered topics that were broadly categorised for the oral and poster presentations including:

- Chemistry and chemical analyses of grape and wine macro-molecules and metabolites;
- Origin and destination of macromolecules and metabolites: From biosynthesis and modification to impact in wine;
- Towards integration: From systems biology to chemical profiles to sensory perception

The travel grant provided by the authority allowed Dr Jun Niimi to attend the Macrowine 2014 conference and present the oral presentation titled "Sensory attribute differences in Cabernet Sauvignon wines of varied provenance can be discriminated with mid-infrared spectroscopy". The travel gave the opportunity to gain new knowledge on wine metabolomics analyses that are being researched across the world and the chance to network with established researchers and keynote speakers of the field.

Executive summary:

Dr Jun Niimi, a postdoctoral fellow at the university of Adelaide, received the AGWA travel grant (at the time, under the name GWRDC travel grant) in order to attend the Macrowine 2014 conference, held in Stellenbosch, South Africa. The conference was held from 7-10 September. Dr Niimi provided an oral presentation - "Sensory attribute differences in Cabernet Sauvignon wines of varied provenance can be discriminated with mid-infrared spectroscopy" and was one of six delegates representing Australian institutions.The Macrowine conference is held biennially, this year was the 5th time the conference that had been organised, and was the first time that the event was held out of Europe. The conference was designed to bring together the world's leading wine scientists to present their work as well as discuss some of the ongoing challenges encountered by both research and industry. Over three and a half days there were eight keynote speakers who spoke at the beginning of the morning and afternoon sessions. A total of 40 oral presentations were given and 65 posters. The main themes covered throughout the conference focussed on wine science and data analysisand there was ample opportunity during session breaks and social events to network with delegates which may lead to collaborations in future projects. As the total number of delegates was approximately 150, the conference was held as one single consecutive session, as opposed to larger conferences that hold concurrent sessions.

Background:

The chemical and sensory properties of wine are very complex; determining the factors that underpin what gives wine its characteristic flavour and aroma is challenging. Many factors can influence the final wine product, including the environment in which the grapes are grown, gene expression leading to metabolite substrate formation, ripening patterns, fermentation characteristics, secondary microflora, and varietal characteristics. Further to this, there are a range of analytical measurement methods available with a plethora of data analysis techniques to choose from, adding to the complexity of the research. Advances in the measurement and analysis methods have enabled researchers to make great advances in understanding the underlying principles that govern the outcome of wine. Such a research field have been of immense interest to the industry across the world to gain a better understanding of the mechanisms at which the quality of wines are affected and to implement some of the research findings to the production process.

The conference brought together the leading scientists in grape and wine science to update and discuss the advances made in the research field. Challenging issues that are still yet to be addressed were mentioned at the conference by the delegates and gave insight to the areas that require further research for better understanding. Macrowine was an appropriate forum to disseminate research of Dr. Niimi in the most effective form through the oral presentation to the other delegates. The travel grant from AGWA provided financial support to attend and deliver the oral presentation at Macrowine 2014.

Project Aims:

The aim of this project was to attend the Macrowine 2014 conference held in Stellenbosch, South Africa, 7^{th} – 10^{th} September, 2014.

Specific aims-

- Give the oral presentation "Sensory attribute differences in Cabernet Sauvignon wines of varied provenance can be discriminated with mid-infrared spectroscopy".
- Gain new and novel knowledge on methodology of research and data analysis techniques that would aid in the research project that Dr. Niimi is involved in.
- Build new networks with scientists in the wine and grape research field.

Conference outcomes:

The abstract entitled "Sensory attribute differences in Cabernet Sauvignon wines of varied provenance can be discriminated with mid-infrared spectroscopy" was submitted for an oral presentation to the scientific committee of Macrowine (Appendix I). Subsequently the abstract was accepted for an oral presentation. The oral presentation was delivered on the final day of the conference, 10th of September, at 11:20am in the session theme "Towards integration: From systems biology to chemical profiles to sensory perception". Critical feedback was received from one of the keynote speakers, who are experts in multivariate statistical analysis and spectroscopy, as well as a fellow Australian researcher who provided suggestions of alternative data analysis methods to better disseminate the results. Contact was established with these researchers, both of whom were very kind and willing to assist with any further data analysis techniques through future personal correspondence. Networking with these delegates was one of the aims of the project.

The opening address was given by Danie Brink from the faculty of Agriscience, University of Stellenbosch who replaced Eugene Cloete, the Vice-Rector: Research and Innovation. Danie discussed innovations and the role of institutions. Importance in the balance of each step that is necessary for the lead up to innovation was discussed. The speaker who followed was Ben Durhan from the Department of Science and Technology. During this presentation, a political strategy in South Africa was presented and outlined the need for interdisciplinary work, as it is currently fragmented in South Africa. A snapshot of the current research situation in South Africa showed that researchers were collaborating internationally well but not nationally.

Many presentations of high calibre were given, however one of the highlights of the conference was the keynote presentation given by Prof. Søren Engelsen of the University of Copenhagen. The topic presented was mainly concerned with coupling chemometric data analysis to quantitative biospectroscopy. Alternative and advanced chemometric data analysis was presented which enable more robust predictive models to be obtained from large spectrometric and spectroscopic data sets. An outline of a process monitoring regime was described, process analysis technology (PAT), which is used online to measure quality as products are being processed. This removes the need to measure quality off line, at the end of production as post-production measurements, and can allow for manipulations during processing for achieving the target outcome. This increases the overall efficiency of processing. Case studies were given for monitoring of malolactic fermentation of wine with time. The speaker called out for an advocate

to adopt the PAT strategy for wine production from grapes due to its potential for producing consistent quality products.

The final keynote speaker was Prof. Linda Bisson of University of California Davis, who presented “Frontiers in wine science: transforming data into art”. One of her main topics addressed was the issues with knowledge transfer to the public and their general misuse/misunderstanding of non-peer reviewed information retrieved from the internet. She stressed that part of the important role of academics was in transmitting proper and reliable scientific information to the public. Academics can assist in determining and solving problems in a logical way that would benefit communities through the delivery of scientific information. Particularly their role is in developing tertiary education students to be critical thinkers by the end of their studentship. Prof. Bisson’s presentation was well received by the audience and was a fantastic closing address for the conference.

APPENDIX I: Conference abstract

Sensory attribute differences in Cabernet Sauvignon wines of varied provenance can be discriminated with mid infrared spectroscopy

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Determining the sensory characteristics of wine with trained assessors is important but protracted and costly. Rapid methods that show differences that relate to wine sensory attributes are sought, such as using mid infrared (MIR) spectroscopy. A total of 25 Cabernet Sauvignon wines were prepared from grapes representing eight different regions across South Australia in 2013. A panel of assessors (n = 12) were trained and generated a vocabulary for the wines for descriptive analysis including colour, aroma, taste, palate flavour, mouthfeel, and aftertaste attributes. Samples were randomly presented and evaluated in triplicate. Wine spectra were recorded in the MIR region between 400cm^{-1} and 4000cm^{-1}. Sensory data was analysed with ANOVA, whilst both the sensory and MIR data underwent principal component analysis (PCA). Across the 25 wines, 13 attributes significantly differed ($p<0.05$) in intensity. Wines separated into regions on the PCA based on the attributes of dark fruit, sweetness, red fruit, bitterness, and acidity. Metabolomic analysis using MIR showed discrimination of the wines based on region in a manner similar to that observed by sensory analysis. Furthermore, wine sensory parameters identified by sensory analysis indicated preliminary relationships to MIR-based spectral profiling. The MIR analysis reported here is rapid, inexpensive and permits simultaneous tentative measurement of organic acids, sugars, and aromatic compounds; that is, metabolites that are associated with region which contribute to wine quality. MIR analysis of wine complements sensory evaluation and offers a more affordable technique to investigate certain sensory aspects of wine.