Winetech Scan
Wine Industry Network of Expertise and Technology • Netwerk van Kundigheid en Tegnologie vir die Wynbedryf

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Local Research

New Winetech projects 2016

Method development – Smoke taint precursors

Researchers: Dr. Astrid Buica and Marianne McKay (Department of Viticulture and Oenology, Stellenbosch University)

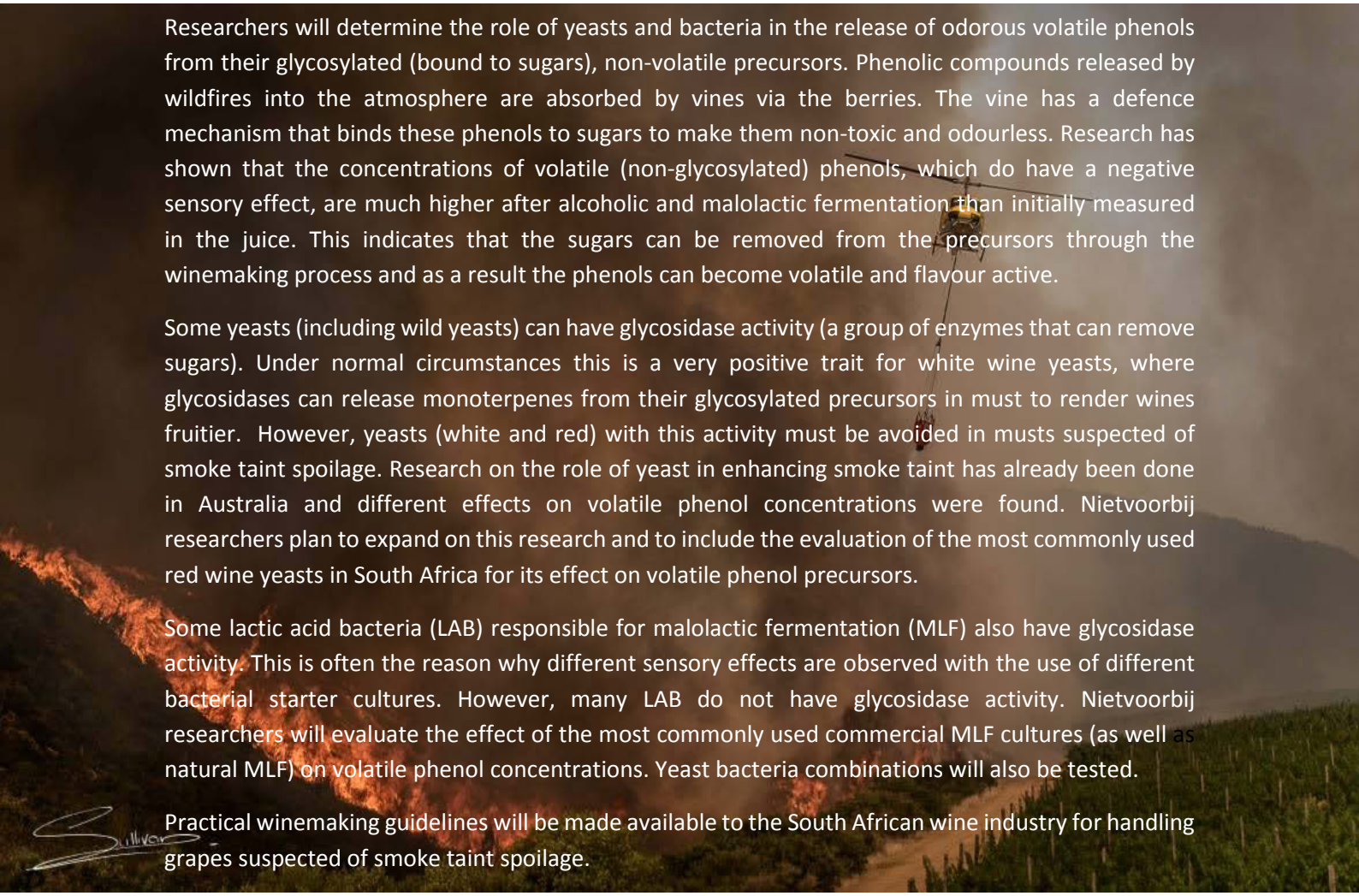
Researchers from the Department of Viticulture and Oenology (DVO), Stellenbosch University (SU) will develop a method to measure the odourless smoke taint precursors in juice and wine. Historically wildfires during our harvest were not very common, but the 2015 season as well as the start of the 2016 harvest season saw devastating fires in our winelands. Wine produced from grapes that were exposed to wildfire smoke can have a smoke-like character, which is unacceptable to consumers. Smoke particles (phenols) released into the atmosphere during a wildfire are absorbed by vines via the grapes. The vine responds with an immune response and binds sugars (glycosylation) to these "foreign" phenols to render them non-toxic and odourless.

The sugars can be released during fermentation by skin contact, enzymes, yeasts, bacteria and the acidic medium during ageing. Once the phenolic compounds are free they become volatile and flavour active. Volatile phenols are measured using a gas chromatograph (GC-MS) in the same way as *Brettanomyces* spoilage (4-ethylphenol and 4-ethylguaiacol - also volatile phenols) are measured. Both SU via its Central Analytical Facility (CAF) and Vinlab can perform volatile phenol analysis. Unfortunately, however, it gives one no indication of the extent of the smoke taint spoilage as it cannot measure the non-volatile (non-gas) smoke taint precursors. A result indicating a low volatile phenol concentration in a wine does not mean you can continue to bottle your wine and sell it. You might get a big surprise after six months or a year as the low pH in the wine gradually removes the sugars from the phenols. It is therefore of critical importance in the light of drier weather conditions, water restrictions, climate change and potential higher occurrence of wildfires that we can measure the iceberg under the water in grapes and wines that were exposed to fires.

The method for measuring the glycosylated phenols involves a very sophisticated (and extremely expensive) machine (LC-MS/MS), which is not available in wine analytical laboratories. It is available at CAF where the method development will take place. At the same time researchers will try to implement a previously published method using enzymes or low pH treatments to remove the sugars from the glycosylated phenols. This will make it possible to use the GC-MS as the phenols will be volatile after treatment.

The contribution of yeast and bacteria to smoke taint spoilage in wine

Researcher: Heinrich du Plessis (Nietvoorbij)



Researchers will determine the role of yeasts and bacteria in the release of odorous volatile phenols from their glycosylated (bound to sugars), non-volatile precursors. Phenolic compounds released by wildfires into the atmosphere are absorbed by vines via the berries. The vine has a defence mechanism that binds these phenols to sugars to make them non-toxic and odourless. Research has shown that the concentrations of volatile (non-glycosylated) phenols, which do have a negative sensory effect, are much higher after alcoholic and malolactic fermentation than initially measured in the juice. This indicates that the sugars can be removed from the precursors through the winemaking process and as a result the phenols can become volatile and flavour active.

Some yeasts (including wild yeasts) can have glycosidase activity (a group of enzymes that can remove sugars). Under normal circumstances this is a very positive trait for white wine yeasts, where glycosidases can release monoterpenes from their glycosylated precursors in must to render wines fruitier. However, yeasts (white and red) with this activity must be avoided in musts suspected of smoke taint spoilage. Research on the role of yeast in enhancing smoke taint has already been done in Australia and different effects on volatile phenol concentrations were found. Nietvoorbij researchers plan to expand on this research and to include the evaluation of the most commonly used red wine yeasts in South Africa for its effect on volatile phenol precursors.

Some lactic acid bacteria (LAB) responsible for malolactic fermentation (MLF) also have glycosidase activity. This is often the reason why different sensory effects are observed with the use of different bacterial starter cultures. However, many LAB do not have glycosidase activity. Nietvoorbij researchers will evaluate the effect of the most commonly used commercial MLF cultures (as well as natural MLF) on volatile phenol concentrations. Yeast bacteria combinations will also be tested.

Practical winemaking guidelines will be made available to the South African wine industry for handling grapes suspected of smoke taint spoilage.

Grapevine cation and anion transfer: a perspective from the soil to wine chemical and sensory properties

Researcher: Dr. Albert Strever (Dept. Viticulture and Oenology, Stellenbosch University)

Saline conditions have been found to negatively impact the vines' physiological responses and biochemical pathways, which result in toxicities, deficiencies and various changes in the mineral balances of a vine and may even lead to decreased growth and yields. Wines made with grapes from areas where soils have high salinity levels, tend to have higher salt concentrations. A very fine line exists between the positive aspects associated with higher sodium chloride (NaCl) concentrations in wine and the negative features, showing a greater need for research delving into the sensorial analysis of specific wines with varying concentrations of NaCl.

The ultimate aim of this project is to consider soil properties, cation and anion content and distribution in the grapevine, as well as it's concentrations in grapes and wine. Local and international

measurement techniques will be addressed in addition to the management of vineyards and grapes from high salt content (saline/sodic) soils. The potential sensory impact of salts in wine will be assessed from a positive as well as potentially negative perspective, and possibly a better definition of terms used like "minerality of wine". The project will give a greater insight into the relationship between the soil, the vine and subsequent wine on the uptake of cations and anions.

Investigating the "recovery phenotype" phenomenon in Aster Yellows-infected grapevines

Researchers: Prof J.T. Burger & Dr H.J.Maree (Department of Genetics, Stellenbosch University) Image: ARC-Infruitec-Nietvoorbij

Since the discovery of Grapevine yellows in local vineyards eight years ago, research made significant progress in the understanding of this disease. The etiological agent was identified as Aster Yellows (AY) phytoplasma and the biological vector as *Mgenia fuscovaria*, reliable diagnostic tools were developed, local genetic variants characterized and the incidence and spread of the disease was determined. There is however still no proven scientific solution to the disease. This preliminary study proposes to investigate the so-called "recovery phenotype" (RP), which has been reported in several other phytoplasma-infected plants and also seems to be at work in local AY-infected grapevines.

Recent studies monitored the AY presence in infected vines that were cut back six years prior to testing, in an attempt to prolong the economic lifespan of the plant. These plants were found to still be symptomless after two years of being cut back and no AY phytoplasma was detected in them. It appears that certain physical or physiological interventions can lead to disease remission, but the mechanism of this recovery phenotype is unknown. It is also proposed that identified bacterial endophytes could act as natural biocontrol.

This project aims to further investigate and gain an understanding of this remission mechanism and recovery phenotype, in the hope of ultimately identifying a practical management procedure that can be implemented in affected vineyards to prolong the productive lifespan of such vineyards. Research can then focus on optimising the parameters of the management procedure.

International Research

The use of polyaspartate as inhibitor of tartaric precipitations in wines

Italian researchers have developed a new additive overcoming all technical limits of present tartrate stabilisation options – potassium polyaspartate. In addition to this very positive trait, this additive is also economic and environmentally sustainable. Potassium polyaspartate is a stable polymer of L-aspartic acid, able to totally inhibit the formation of tartrate crystals, even in highly unstable wines and without colour loses (red wine) and an effect on wine filterability. The OIV is currently in Step 5 of legalising its use in winemaking. Maximum dosage is 10 g/hL and red wines with high colloidal instability must be treated with bentonite first.

Bossa, A. *et al.* (2015). Use of polyaspartate as inhibitor of tartaric precipitations in wine. Food Chemistry 185, 1-6.

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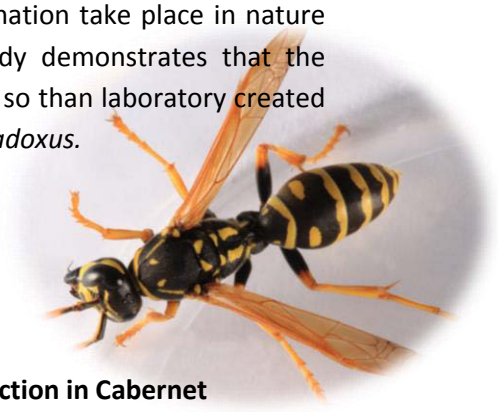
Social wasps are a *Saccharomyces* mating nest

Researchers have found that the guts of wasps serve as environmental alcoves in which yeasts (from the same and different species) can meet and mate. The existence of various inter- and intra-specie hybrids is an indication that yeasts regularly mate and reproduce through their sexual lifecycle in nature. However, the place where this mating and recombination take place in nature has not been identified yet… until now. This recently published study demonstrates that the intestines of wasps favours the mating of *Saccharomyces* strains – more so than laboratory created conditions. It also promotes the hybridisatrion of *S. cerevisiae* and *S. paradoxus.*



Stefanini *et al.* (2015). Social wasps are a *Saccharomyces* mating nest.

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Effects of Cap and Overall Fermentation Temperature on Phenolic Extraction in Cabernet Sauvignon Fermentations

Researchers found that the cap and must temperature had noticeable effects on red wine phenolic extraction based on where the phenolics originated. For skin phenolics, temperature affected the rate of extraction but not the final concentration, and increasing temperatures favoured faster extraction. For seed phenolics, increases in fermentation temperature increased both the rate of extraction and the final concentration. Results showed that must temperature was more important than cap temperature in driving extraction of phenolics.

To determine the effects of temperature on phenolic extraction, research scale (120 L) Cabernet Sauvignon fermentations were performed in which the cap and must were either maintained at the same temperature or a constant thermal gradient was maintained between the two during the period of active fermentation. All fermentations were sampled twice daily and phenolic content was determined by reverse-phase high-performance liquid chromatography for the monomeric phenolics and UV-vis spectroscopy for the total anthocyanins and condensed tannins.

Lerno, L. *et al.* (2015). Effects of Cap and Overall Fermentation Temperature on Phenolic Extraction in Cabernet Sauvignon Fermentations. Am. J. Enol. Viti. 66 (4), 444-453.

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