Winetech Scan
December 2014
Wine Industry Network of Expertise and Technology
Netwerk van Kundigheid en Technologie vir die Wynbedryf

Local Research News

Graft union abnormality

Plant cell division gives rise to callus tissue and is the normal healing process in plants. Callus production is essential to the formation of a graft union and the promotion of rapid callusing of the graft union is an important parameter for effecting grafting. Callus formation is influenced by light, pressure, moisture, chemical growth regulators and particularly temperature, which has an especially strong influence. The origin and prevention of the phenomenon of abnormal enlargement of graft unions (graft union abnormality) has been investigated. In vineyards where the phenomenon occurs, plants apparently develop normally in the nursery, but as soon as they are exposed to the vineyard environment, the graft union starts to increase in size and rootstock development is retarded. The scion (grafted shoot) then becomes visibly thicker than the rootstock and the graft union becomes excessively large. This can lead to the death of the whole plant.

Material from Sauvignon blanc, Cabernet Sauvignon and rootstock Richter 110 and 101-14 Mgt was collected and combinations of Sb/R110, CS/R110, Sb/101-14 Mgt, CS/101-14 Mgt were warm and cold callused, and a hot water treatment or no treatment was applied for each combination. The general trends observed over a three year growing period were that C. Sauvignon had thicker graft unions and rootstock diameters than S. blanc, and that warm callusing would lead to the thickest graft unions and thinnest rootstocks, irrespective of the graft combination and was thus the major factor in graft union abnormality. Cold callusing was likely to result in the thinnest graft union and thickest rootstock, and therefore a more balanced vine. Most vine deaths occurred during the second growth season and deaths did not increase after that. www.sawislibrary.co.za/dbtextimages/HunterJJ14.pdf

Metabolic engineering of yeast to enhance flavour and aroma development during wine fermentation

Cultivar-specific flavour and aroma compounds present in grapes play a major role in the ultimate quality of the wine. These compounds, that include monoterpenes, sesquiterpenes and norisoprenoids, are formed exclusively in the plant and are extracted from the grapes during the wine making process. A project identified and isolated genes that potentially play a role in the formation of such flavour and aroma compounds. These genes were the terpene synthases/cyclases (TPS) and the carotenoid cleavage dioxygenases (CCD). These genes have been cloned into yeast expression vectors and transformed, in various combinations, into yeast strains co-expressing grapevine terpene synthases. The resultant recombinant yeast strains were evaluated for their volatile flavour/aroma production. As an example, expression of two of the additional three genes investigated that were expressed to improve flux to monoterpene production in yeast, led to a 8-fold increase in the (-)-terpenin-4-ol levels. A genetic screen for mutants with changed aromatic profiles was also investigated. Work on metabolic regulation in yeast led to the establishment of semi-predictive metabolic models which can be used to design improved strategies for enhancing aroma production in yeast. www.sawislibrary.co.za/dbtextimages/BauerFF9.pdf

International Research News

Bacterial endophytes in grapevines

An endophyte is an organism, usually a bacterium or fungus, that lives within a plant for at least part of its life without causing apparent disease. Endophytes are ubiquitous. Because endophytes hold a great potential for the implementation of a more sustainable, bio-based agriculture, a study investigated the differences between endophytic bacterial populations isolated from wild and domesticated grapevines. Bacterial isolates from a total of 88 wild and domesticated grapevines that had shared the same climate for at least four years were identified and a representative set of 155 strains was characterised for 30 features, encompassing quorum sensing-related, enzyme production, antibiotic resistance, plant growth promotion and biocontrol traits. The microbial diversity was found to be higher in wild grapevine plants (twenty-five genera), as compared to domesticated grapevines (six genera). Interestingly, endophytes from domesticated grapevines were more likely to perform well in plant growth promotion and biocontrol tests when compared to endophytes from wild grapevines, suggesting that the decrease in taxonomic diversity in domesticated grapevine microbiota did not correspond to a loss of agriculturally relevant traits, which may be due to human selection during propagation of grapevines. http://dx.doi.org/10.5344/ajev.2014.14046

Loss of colour in Pinot noir wine

The loss of Pinot noir wine colour and its linkage to the reduction in the amount polymeric pigment caused by malolactic fermentation (MLF) was investigated. Pinot noir wines were held at 13°C for 0, 14, 28, 100 and 200 days before inoculation with the lactic acid bacteria *O. oeni* VFO. Delaying MLF did not impact loss of colour at 520 nm but delaying MLF for increasing time periods reduced the loss of polymeric pigment to the point that after 200 days no loss was noted. The role of acetaldehyde and/or pyruvic acid degradation by *O. oeni* during MLF was investigated as a cause for reduced polymeric pigment formation. Wines that had undergone MLF were supplemented with acetaldehyde and/or pyruvic acid to the levels measured in control wines that did not undergo MLF. Wines with acetaldehyde additions had higher colour and polymeric

pigment than MLF wines with no additions, while addition of pyruvic acid resulted in no improvement in colour or polymeric pigment. However, as acetaldehyde additions did not completely prevent loss of colour after MLF, the possibility that this colour loss was due to fining by *O. oeni* was explored, but was rejected as a cause. The results suggest that winemakers may be able to improve the polymeric pigment content of Pinot noir wine by delaying MLF while storing wine at cool cellar temperatures to prevent microbial spoilage. The selection of high acetaldehyde producing yeast or use of *O. oeni* strains that do not metabolize acetaldehyde may also reduce colour loss due to MLF. http://dx.doi.org/10.5344/ajev.2014.14061

Wood impregnation of yeast lees for winemaking

A new method to produce more complex wines by means of an indirect diffusion of wood aromas from yeast cell-walls has been developed. Four different types of wood were used in the study; chestnut, cherry, acacia and oak. An exogenous lyophilized yeast biomass was macerated with an ethanol solution of each wood extract resulting in the adsorption of the wood polyphenols and volatile compounds by the yeast cell-walls. Chemical analysis demonstrated that the adsorption/diffusion of these compounds from the wood to the yeast had taken place. Red wines were also aged with *Saccharomyces cerevisiae* lees that had been separately impregnated with each of the wood aromas and subsequently dried. Large differences were observed between the four wood types studied with regards to their volatile and polyphenolic profiles. Sensory evaluations confirmed the large differences, showing that the method could be of interest for red wine making. In addition, the results demonstrated the potential of using wood other than oak in cooperage. http://dx.doi.org/10.1016/j.foodchem.2014.08.108

Compounds responsible for the foam properties of white and rosé sparkling wines

Natural sparkling wine produced with the *champenoise* method is the final product after two fermentations followed by an ageing period of at least 9 months with yeast inside the bottle. Foam characteristic is the first attribute observed by the consumer, so the foam of a sparkling wine is a key parameter of its quality. Quality foam can be defined as one that causes a slow release of CO_2, in ring shapes from the depths of the liquid, with small bubbles that contribute to the formation of a crown over the surface of the wine, covering it completely, and with bubbles two or three rows deep. Foam duration is directly related to bubble stability, and stability is itself dependent on the composition of the film that supports it. Foaming properties depend on compounds that decrease surface tension and increase the viscosity of the film between the bubbles. This factor contributes to foam stabilization and renders the bubbles more resistant to coalescence.

The compounds responsible for the foaming properties of white and rosé sparkling wines have been investigated. Results demonstrated the positive contribution of anthocyanins and amino acids to the foamability parameters HM (maximum height reached by foam after CO_2 injection) and HS (foam stability height during CO_2 injection), and the negative contribution of proanthocyanidins. Mannoproteins and polysaccharides rich in arabinose and galactose (PRAG) were poor foam formers but good foam stabilizers. The different forms of malvidin showed the highest influence on the HM and HS parameters, followed by amino acid compounds, mainly b-alanine. Foam stability was only affected by polysaccharides (PRAG). http://dx.doi.org/10.1016/j.foodchem.2014.10.080

Prefermentative cold soak

The winemaking technique known as prefermentative cold soak (CS) has gained widespread use for the production of red wines. It consists of the contact of fermentation solids (skins, seeds and occasionally stems) with the must in a non-alcoholic and low-temperature environment prior to the onset of alcoholic fermentation. The absence of ethanol is ensured by keeping the must at low temperatures (5 to 10°C), for a variable period of time (3 hours to 10 days)

Six red grape cultivars, Barbera D'Asti, Cabernet Sauvignon, Malbec, Merlot, Pinot Noir and Syrah, were produced with or without prefermentative cold soak (CS). The cold soak consisted of 4 days of CS at about 9°C, which temperature was achieved by periodic additions of dry ice (solid CO_2). Cold soak had no effect on the basic chemical composition of the wines. At pressing, CS wines were more saturated and with a higher red component than control wines. After 1 year of bottle aging, CS wines retained 22% more anthocyanins than control wines, but tannins and total phenolics remained unaffected. Both saturation and the red component of colour were slightly higher in CS wines. From a sensory standpoint, CS only enhanced colour intensity in Barbera D'Asti and Cabernet Sauvignon wines, whereas it diminished colour intensity in Pinot Noir. Cold soak had no effect on perceived aroma, bitterness, astringency and body of the wines. The study concluded that in a current global context of both low-input viticulture and oenology, the use of CO_2 to conduct CS in red grapes appears to be of little merit. http://dx.doi.org/10.1016/j.foodchem.2014.10.146

Overestimating the antioxidant potential of white wines

Numerous studies have shown that phenolic compounds in wine have a high antioxidant potential (AOP) due to their free radical- scavenging properties. As the making of white wines does not include maceration, white wines contain lower levels of phenolic compounds and consequently have lower AOPs than do red wines. However, in white wines, the correlation between AOP and phenolic levels is less pronounced than in red wines, suggesting that non-phenolic components might also contribute to the AOP. It has now been found that the analysis of white wines with 'DPPH' and 'FC' assays overestimate the contribution of phenolics to the antioxidant potential (AOP) by between 20 to 45%. This is because of the presence of sulphur dioxide in the wine, which has now been shown to interfere with the analysis. http://dx.doi.org/10.1016/j.foodchem.2014.11.030

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