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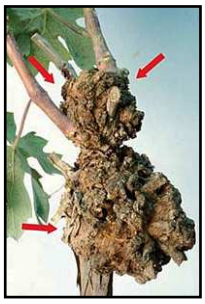
International Research News

Biological control options and genetic engineering tools for grapevine crown gall suppression



A review article examines the potential use of biological control and genetic engineering tools for grapevine crown gall (CG) suppression. CG is a devastating grapevine disease often encountered in vineyards that are prone to winter cold injury. *Agrobacterium vitis*, the predominant causal agent, moves from the roots via xylem sap flow to freeze injury sites where genetic transformations then occur. It disrupts the grapevine trunk vascular system, preventing nutrient flow, and leads to plant decline and death. Viticultural practices designed to fight this disease are only partially effective and genetic engineering and biological control could be more desirable approaches for GC prevention.

Biological control typically involves antagonistic organisms, which are applied to grapevine roots to reduce the concentration of pathogenic *Agrobacterium* strains. Genetic engineering may prevent infection and tumour formation by modifying grapevines and antagonistic organisms. In the grapevine, this may be achieved by enhancing molecular mechanisms for producing bacterium-specific antimicrobial peptides or preventing transferred DNA export, integration, and oncogene expression. Alteration of antagonistic organisms enhances the production of bacteriocins effective against agrobacteria. The genetic diversity of *Agrobacterium* grapevine isolates is considered the major limitation for successful biological control. Genetic mechanisms that trigger malignant cell growth and underlie CG formation are still not completely understood. Determination of currently unknown grapevine and *Agrobacterium* genes involved in the grape CG infection and genetic transformation processes and their exact roles would enhance understanding of the mechanisms of this disease. Successful suppression of grapevine CG is likely to be achieved by incorporating and applying strategies from both biological control and genetic engineering. http://dx.doi.org/10.5344/ajev.2012.12038

Foliar application of urea to Sauvignon Blanc and Merlot vines

Researchers have examined the effect of foliar application of urea to provide nitrogen (N) at different doses and different times of the growing season on Sauvignon Blanc and Merlot grape juice over a two year period. In the first year, the foliar application was a dose of 10 kg N per ha during veraison, and in the second year it was two doses (10 and 50 kg N per ha) at three different times: 3 weeks before veraison, during veraison, and 3 weeks after veraison. In the second year, the urea applied at a dose of 10 kg N per ha was isotopically labelled. Chemical parameters, yeast assimilable N, amino acid content, amino acid profile and N isotopic composition were determined for all treatments.

Berry size showed no clear relationship to foliar fertilization or the stage at which it was applied for either variety. Grape and grape-juice parameters (total acidity, degrees Baume, sugar content and probable alcohol content) for Merlot were found to be more affected by N fertilization than the same parameters for Sauvignon Blanc, and were also more affected during the second year than during the first year, thus indicating that the climatic characteristics of each campaign could affect these parameters. The yeast assimilable N in grape juice was found to be higher for late applications of foliar urea, with application of the higher dose of urea during veraison increasing the amino acid and proline contents in both varieties. The isotopic analysis data showed that the urea applied to leaves was transferred to the berries, with the maximum translocation in Sauvignon Blanc occurring for the post-veraison treatment and in Merlot for the veraison treatment. Foliar application of urea can modify grape juice quality and thus could be used to improve wine quality. http://dx.doi.org/10.1007/s10725-012-9667-5

The precursors of fermentation-derived esters

To identify grape-derived precursors to acetate esters, model fermentation systems were developed by spiking precursors into model must at different concentrations. Analysis of the fermented wines showed that a variety of grape-derived aliphatic alcohols and aldehydes are precursors to acetate esters. The C6 compounds hexan-1-ol, hexenal, (E)-2-hexen-1-ol, and (E)-2-hexenal are all precursors to hexyl acetate, and octanol and benzyl alcohol are precursors to octyl acetate and benzyl acetate, respectively.

A clear, linear relationship exists between the pre-fermentation must concentrations of the alcohol/aldehyde substrates and the post-fermentation concentration of the corresponding acetate esters in these model ferment series. Determining viticultural or winemaking methods to alter the pre-fermentation concentration of precursor compounds or changing the precursor-to-acetate ester ratio will have implications upon the final flavour and aroma of wines. With some idea of ester potential in a grape juice must, the winemaker could alter winemaking variables such as yeast strain and/or fermentation temperatures to produce a wine with an appropriate level of fruitiness for the desired wine style. http://dx.doi.org/10.1021/jf2042517

The expression pattern of b-glucosidase genes during grape berry maturation and dehydration stress

Fruit ripening is a complex physiological and biochemical process regulated by genes and influenced by the environment. Little is known about the molecular mechanisms regulating the ripening of non-climacteric fruit such as grapes. For many of such

fruits, ripening is regulated by abscisic acid (ABA), a plant hormone. To investigate the role of b-glucosidase gene expression in modulating ABA levels, the expression pattern of three complementary DNAs (VvBG1, VvBG2 and VvBG3) which encode b-glucosidase in ripening grape berries was analyzed in the presence or absence of dehydration stress. b-glucosidase is a common enzyme which catalyzes the hydrolysis of the glycosidic linkage of carbohydrates (sugars) to release smaller sugars.

The expression of these three VvBG genes was markedly different. Expression of VvBG1 and VvBG2 increased rapidly from veraison to reach a maximum at or several days immediately before harvest, and coincident with ABA accumulation during berry development and ripening. Expression of VvBG3 differed in that transcript levels declined from the early young fruit stage through veraison after which there was no further change. At 10 days before harvest, dehydration treatment of detached grape berries up-regulated the expression of VvBG1 and enhanced ABA accumulation, whereas the expression of VvBG2 was down-regulated. VvBG3 was unaffected by dehydration stress. However, in the leaves, dehydration treatment up-regulated the expression of VvBG1 and stimulated the accumulation of ABA but down- regulated expression of VvBG2 and VvBG3. It was concluded that the expression pattern of the three VvBGs is both temporal and tissue specific, and might play a role in the regulation of ABA content during berry ripening and in berry response to dehydration stress.
http://dx.doi.org/10.1007/s10725-012-9782-3

Effect of packaging and temperature on Cabernet Sauvignon

Californian Cabernet Sauvignon was stored in five different wine-packaging configurations at 10, 20 and 40ºC for 6 months in the dark so as to study the combined effects of packaging and temperature on the sensory and chemical properties of the wine. The packaging was three different bottle closures (natural cork, synthetic cork, and screw cap) and two bag-in-box configurations (with and without modified atmosphere). Generally, changes were more pronounced due to storage temperature, with 30 sensory attributes differing significantly among the three different storage temperatures, while only 17 sensory attributes showed a significant packaging effect. With increasing storage temperature the packaging effect became more pronounced, resulting in the largest changes in the Bag-in-Box samples stored at the highest temperature. At 40ºC, all wines showed oxidized characters, independent of wine packaging, but to a varying degree.

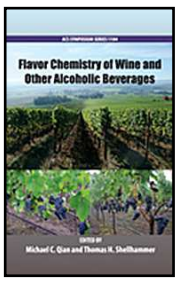
Generally, wines that received highest oxygen amounts and storage temperatures were much lighter, less red, and more brown-yellow at the end of the 6-month storage period, compared to their counterparts stored at 10ºC. With increasing storage temperature, spectrophotometric assays measured reduced concentrations in total phenols and total anthocyanins, while total tannins, degree of ionized anthocyanins, and colour density increased. Various volatile compounds differed significantly among the samples, with the largest relative concentration changes in acetates, organic acids, and alcohols, with some being well correlated to specific sensory attributes. Storage at elevated temperatures could be a valuable tool for selecting wine packaging type, and for the testing of new types of wine packaging. http://dx.doi.org/10.1021/jf3051736

Wild pollinators enhance fruit set of crops regardless of honey bee abundance

A study of 600 fields of 41 crop systems in 19 countries from all continents (including mango and sunflower in South Africa) has found that managed honey bees are not as successful at pollinating crops as wild insects (primarily wild bees) suggesting the continuing loss of wild insects in many agricultural landscapes has negative consequences for crop harvests. Although the this study does not refer to grapevines, as they are largely self-pollinating, it is here included for interest. The study shows that there is a positive association of fruit set with wild-insect visits to flowers in all 41 crop systems, and thus clearly demonstrates their agricultural value. Fruit set refers to the number of flowers on a plant that develop into mature fruits and seeds, a process largely aided by insect pollination in agricultural crops. In contrast, fruit set increased significantly with visitation by honey bees in only 14% of the systems surveyed. Overall, wild insects pollinated crops more effectively, because increases in their visitations enhanced fruit set by twice as much as an equivalent increase in honey bee visitation. Further, visitation by wild insects and honey bees promoted fruit set independently, so a high abundance of managed honey bees supplemented, rather than substituted for, pollination by wild insects. The results suggest that new practices for integrated management of both honey bees and diverse wild-insect assemblages will enhance global crop yields. http://dx.doi.org/10.1126/science.1230200

Other news

Book: Flavor Chemistry of Wine and Other Alcoholic Beverages



This book (published March 2013) is an outcome of the American Chemical Society symposium 'Flavor Chemistry of Alcoholic Beverages' held in 2010 and is intended as a reference work. A section of the book is devoted to the flavour and flavour precursors in wine grapes and their conversion in wine. Since these aroma and aroma precursors are the secondary metabolites of plants, their biotransformation and accumulation are directly influenced by environment and viticultural practice in the vineyard. Another significant section focuses on aging processes during wine production. Aging is a dynamic process involving both volatile and non-volatile compounds with some degrading, whereas others are formed. Understanding these processes is of economic importance, particularly for wine as aging can be such a critical step in its production.

To see more, including the table of contents, go to http://ukcatalogue.oup.com/product/9780841227903.do#.UVBHUJZAjfE