

Technical Report

Grapevine Flower Treatment with Gibberellic Acid (GA₃) increases o-Aminoacetophenone (AAP) Content in some *Vitis vinifera* L. Wines

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Six cultivars of Vitis vinifera L. ('Chardonnay', 'Riesling', 'Sauvignon blanc', 'Kadarka', 'Lemberger', and 'Merlot') were sprayed at full bloom with a 20ppm solution of gibberellic acid. Compared to the untreated control some of the wines from gibberellic acid treated grapevines showed higher contents of o-aminoacetophenone (AAP), which is closely linked to the untypical ageing (UTA) off-flavour. These results, thus, support our earlier findings that gibberellic acid treatment of grapevine flowers might lead to higher UTA formation potential in Vitis vinifera L. wines.

Key words: gibberellic acid; o-aminoacetophenone (AAP); untypical aging flavour (UTA); GC/MS

Gibberellins are an important class of natural growth regulators in plants. They are products of the diterpenoid pathway and their formation is initiated by cyclisation of the common C₂₀ precursor geranylgeranyl diphosphate (GGPP) (GRAEBE et al., 1965; HEDDEN and PROEBSTING, 1999). GA₃ has been widely used in table grape production and its effects on grape quality have been intensively studied (GUELFAT-REICH and SAFRAN, 1973; BEN-TAL, 1990; KORKAS et al., 1999). Recent research has shown, that GA₃ treatment not only leads to higher polyphenol and anthocyanin content, respectively, but also to higher concentrations of indole-3-acetic acid and o-aminoacetophenone in 'Riesling' and 'Sauvignon blanc' wine (TESZLÁK et al., 2005; POUR NIKFARDJAM et al., 2005a and b).

Aminoacetophenone (AAP) is an aroma compound, which is associated with the so-called 'untypical ageing off-flavour' (UTA) in *Vitis vinifera* L. white wines and generally occurs after a few months storage. The off-flavour is described by various aroma descriptors, such as 'acacia blossom, naphthalene, furniture polish, wet wool or fusel alcohol'. Depending on wine flavour UTA can be organoleptically recognised at concentrations

as low as 0.7 µg/L AAP (RAPP et al., 1995).

An increased AAP content of wines as a result of GA₃ treatment of grapevine flowers would, thus, militate against such a treatment. Since our recent findings already showed that 'Riesling' and 'Sauvignon blanc' wines made from GA₃ treated grapevines develop significantly more AAP during storage (POUR NIKFARDJAM et al., 2005b), we extended our study to more varieties to see if GA₃ generally leads to higher AAP concentrations in wine.

Material and Methods

All reagents used were of analytical grade unless otherwise stated. Gibberellic acid (GA₃) and Tween 20[®] were from Fluka (Buchs, Switzerland).

Vineyard parameters: Grapes were grown during the 2005 vintage in the „Szent Miklós“ vineyard of the FVM Research Institute for Viticulture and Oenology on the south-facing slopes of the Mecsek Hills in Pécs/Hungary (latitude: 46°07' N, longitude: 18°17' E, 180-200 meters above sea level). The soil is Ramann-type brown duff on red sandstone. The vines were not irri-

gated. The five-year-old 'Riesling', 'Sauvignon blanc', and 'Chardonnay' grapevines were grown according to the Lenz-Moser system. The 22-year-old red varieties 'Kadarka', 'Lemberger', and 'Merlot' were grown according to the Pendelbogen system. In each case 100 grapevines were selected from each variety, of which 50 were kept untreated (control) and 50 were treated with GA₃ as follows.

GA₃ treatment: Grapevine flowers were sprayed at full bloom to the drip point with an aqueous 20ppm GA₃ solution (containing 0.2% Tween 20[®]).

Winemaking technology: The grapes were harvested manually at physiological ripeness, destemmed, and crushed by means of a Cantinetta C.D.A. TR (Nuova Zambelli, Camisano Vicentino, Saonara, Italy) destemmer/crusher. The grapes then received 20mg/kgSO₂.

After destemming and crushing the white mashes were immediately pressed by means of a hydraulic press and the resulting must divided in 20-liter glass balloons resulting in three replicates for each variety and treatment. They were then inoculated with Lalvin[®] EC 1118 (Lallemand, Rexdale, Canada) starter culture and fermented for one week. After fermentation was complete, the wines were racked off the lees, received 50 mg/L SO₂, and were then stored at 14 °C in the dark till analysis.

The red mashes (three replicates for each variety and treatment) were also transferred into 20-liter glass balloons and Opti-Red[®] (Lallemand, Rexdale, Canada) was added to induce fermentation. During open mash fermentation the wines were manually plunged three times a day. After fermentation and prolonged skin contact for a total timeframe of 4 weeks, the wines were racked off the lees, received 50mg/L SO₂ and were then stored at 14 °C in the dark till analysis.

Wine analysis: o-AAP analysis by means of GC/MS was performed as described elsewhere (POUR NIKFARDJAM et al., 2005b).

Statistics: All statistical calculations were carried out using Microsoft Excel[®] (Microsoft Corp., Redmond, USA) and SPSS[®] (SPSS Corp., Chicago, USA).

Results and Discussion

GC/MS analysis showed that AAP content is increased in 'Chardonnay', 'Riesling', 'Lemberger', and 'Merlot' wines made from GA₃ treated grapevines, albeit this trend is not always statistically significant at p < 0.05 level (Table 1). At p < 0.13 level the differences are statistically significant for all four varieties.

Tab. 1: 2-Aminoacetophenone (AAP) content of white and red wines made from GA₃ treated and untreated grapevines (n=3)

Variety	Treatment	AAP (µg/L)
Chardonnay	GA ₃	0.40 ± 0.01 *
	control	0.21 ± 0.06
Riesling	GA ₃	0.39 ± 0.12
	control	0.25 ± 0.0
Sauvignon blanc	GA ₃	0.10 ± 0.15
	control	0.10 ± 0.06
Kadarka	GA ₃	0.20 ± 0.07
	control	0.38 ± 0.12
Lemberger	GA ₃	1.44 ± 0.30 **
	control	0.65 ± 0.14
Merlot	GA ₃	1.01 ± 0.21
	control	0.82 ± 0.18

* p < 0.05; ** p < 0.01

Our results for 'Riesling' and 'Sauvignon blanc' are much lower than our recent findings for the 2004 vintage. In 2004 we found: 'Riesling': GA₃ 1.29 µg/L, control 0.72 µg/L; 'Sauvignon blanc': GA₃ 1.26 µg/L, control 0.83 µg/L (POUR NIKFARDJAM et al., 2005b). As already discussed elsewhere (POUR NIKFARDJAM et al., 2005c) GA₃ treatment of grapevine flowers might artificially induce slight water-stress in grapevines and, thus, lead to higher AAP contents in the respective wines. The higher precipitation in 2005 compared to 2004 would, therefore, diminish the impact of GA₃ treatment and explain the lower AAP concentrations measured in 2005. In 2004 we had 561mm of rainfall during the vegetation period (April-October), while in 2005 it was 630mm (+12%).

The lower AAP content in the GA₃-treated 'Kadarka' wine could be due to its very low ripening stage at harvest (75.6°Oe, 15.3g/L titratable acidity). Only the 'Lemberger' and 'Merlot' wines contained AAP concentrations above the sensory threshold of 0.7 µg/L as introduced by RAPP et al. (1995). Although a sensory panel has not yet evaluated the wines, we speculate that none of the wines will show UTA off-flavour during the sensory. CHRISTOPH et al. (1995) found a threshold level of 1.5 µg/L for AAP in red wines. Thus, despite the AAP concentrations in 'Lemberger' (max. 1.76 µg/L) and 'Merlot' (max. 1.15 µg/L), the off-flavour will most likely not be detectable due to the masking effect of polyphenols in these wines as already discussed elsewhere (CHRISTOPH et al., 1995; POUR NIKFARDJAM et al., 2005b).

As a result our results support our earlier findings that

GA₃ treatment of grapevine flowers might increase AAP content in some varieties. The application of this phytohormone to achieve looser grape clusters (as a means against bunch rot and related diseases) is, thus, connected with certain risk factors. More studies are necessary to analyse the influence of GA₃ during varying weather conditions on the AAP content of *Vitis vinifera* L. wines.

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Erratum

Der Artikel

„Polyphenole und antioxidative Kapazität in österreichischen Weinen aus konventioneller und biologischer Traubenproduktion“

von OTREBA, J.B. et al. (Heft 1-2, 2006) wurde irrtümlicherweise nicht in der endkorrigierten Version in Druck gegeben.

Auf Seite 24, rechte Spalte, letzter Absatz muss der Satz

„Unvermeidlich, wengleich auch umstritten ist der Einsatz von Kupferpräparaten gegen *Oidium*.“

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Wir bedauern das Versehen.

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