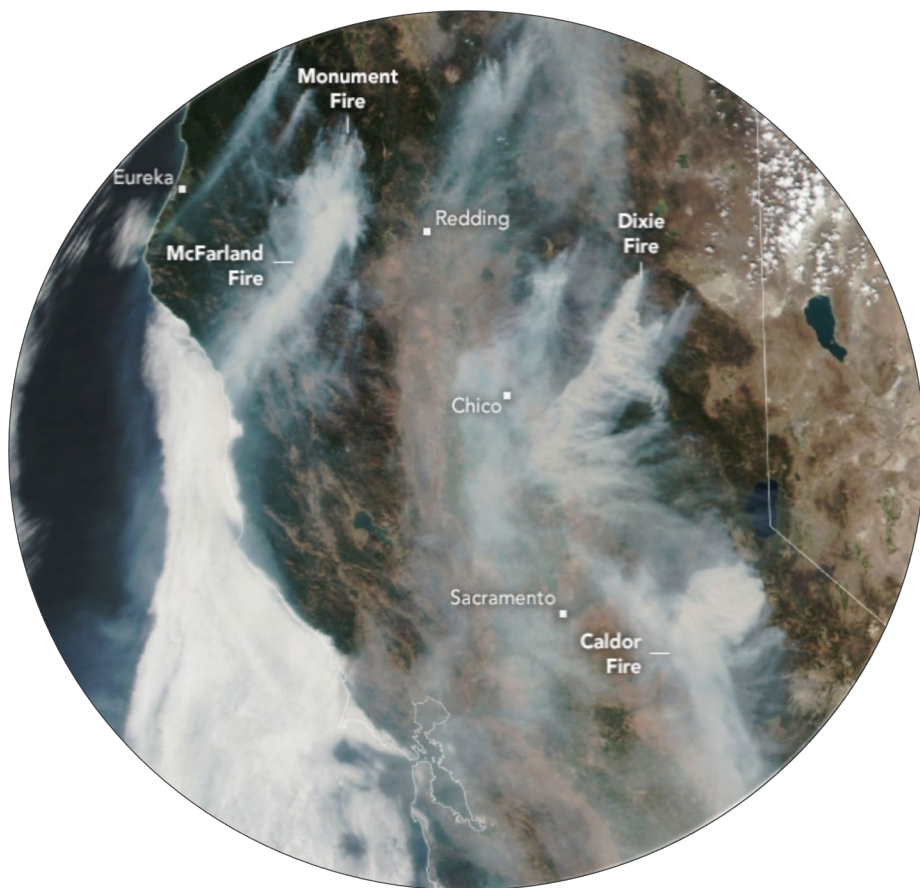


WILDFIRE SMOKE MARKERS IN GRAPES: BASELINE 2021 - 2022



Dr. ERIC HERVÉ
ETS LABORATORIES

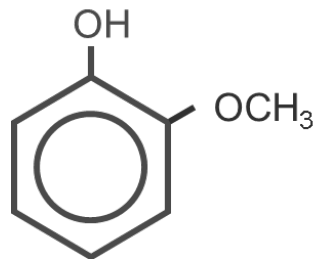
Oregon Wine Symposium
15 February 2023

WILDFIRE SMOKE MARKERS IN GRAPES: BASELINE 2021 - 2022

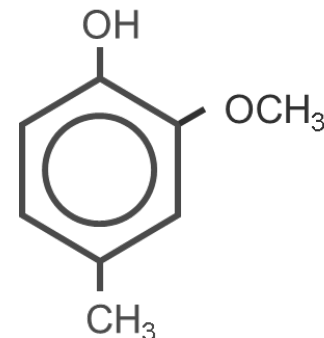
1. Smoke Markers in Grapes and Wines
2. Baseline Levels in Grapes from the US West Coast
3. Comparison with the AWRI Database

VOLATILE MARKERS

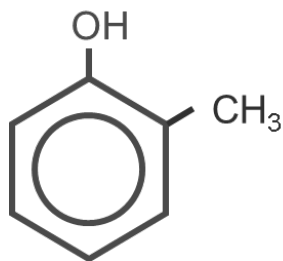
Guaiacol



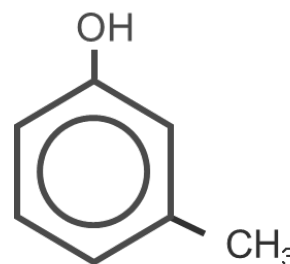
4-Methylguaiacol



o-Cresol



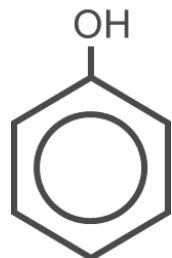
m-Cresol



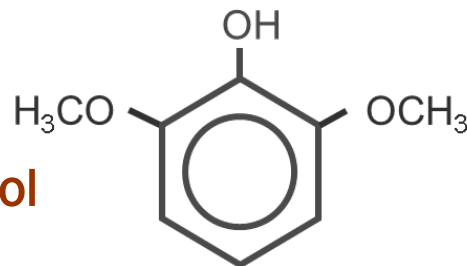
p-Cresol



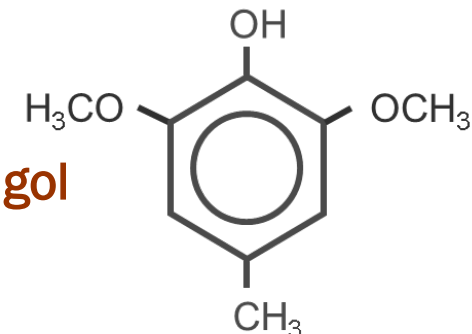
Phenol



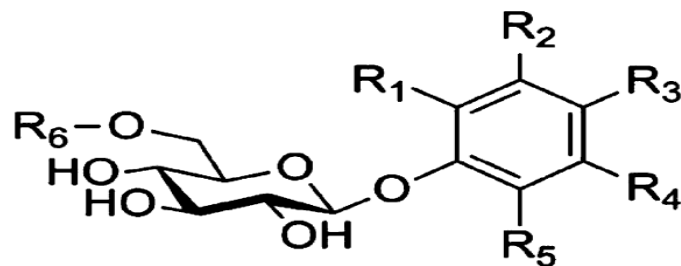
Syringol



4-Methylsyringol



GLYCOSYLATED MARKERS



| | R ₁ | R ₂ | R ₃ | R ₄ | R ₅ | R ₆ |
|--|------------------|---|-----------------|----------------|------------------|----------------|
| 1: Phenol gentiobioside | H | H | H | H | H | glucose |
| 1a: Phenol pentosylglucosides | H | H | H | H | H | pentose |
| 1b: Phenol rutinocide | H | H | H | H | H | rhamnose |
| 2: Cresol gentiobioside | | R ₁ , R ₂ or R ₃ = CH ₃ | | | | glucose |
| 2a: Cresol pentosylglucosides | | R ₁ , R ₂ or R ₃ = CH ₃ | | | | pentose |
| 2b: Cresol rutinocide | | R ₁ , R ₂ or R ₃ = CH ₃ | | | | rhamnose |
| 3: Guaiacol gentiobioside | OCH ₃ | H | H | H | H | glucose |
| 3a: Guaiacol pentosylglucosides | OCH ₃ | H | H | H | H | pentose |
| 3b: Guaiacol rutinocide | OCH ₃ | H | H | H | H | rhamnose |
| 4: Methylguaiacol gentiobioside | OCH ₃ | H | CH ₃ | H | H | glucose |
| 4a: Methylguaiacol pentosylglucosides | OCH ₃ | H | CH ₃ | H | H | pentose |
| 4b: Methylguaiacol rutinocide | OCH ₃ | H | CH ₃ | H | H | rhamnose |
| 5: Syringol gentiobioside | OCH ₃ | H | H | H | OCH ₃ | glucose |
| 5a: Syringol pentosylglucosides | OCH ₃ | H | H | H | OCH ₃ | pentose |
| 6: Methylsyringol gentiobioside | OCH ₃ | H | CH ₃ | H | OCH ₃ | glucose |
| 6a: Methylsyringol pentosylglucosides | OCH ₃ | H | CH ₃ | H | OCH ₃ | pentose |

Hayasaka, 2013

GLYCOSYLATED MARKERS

Fall 2020:

Initiated by the Wine Institute Technical Committee -
Agreement between ETS Laboratories, the AWRI and major
wineries for:

- . A common list of glycosylated markers
- . Pure reference compounds and their isotopic analogues
(internal standards) to be synthesized

GLYCOSYLATED MARKERS

December 2020:



Toronto Research Chemicals
products for innovative research

Reference glycosylated compounds and their isotopic analogues have been synthesized and are commercially available

GLYCOSYLATED MARKERS

| Volatile (=“Free”) Markers | Glycosylated (=“Bound”) Forms |
|---------------------------------------|--|
| Guaiacol | Guaiacol Rutinoside |
| 4-Methylguaiacol | 4-Methylguaiacol Rutinoside |
| ortho-, meta- and para- Cresol | ortho-, meta- and para- Cresol Rutinoside |
| Phenol | Phenol Rutinoside |
| Syringol | Syringol Gentiobioside |
| 4-Methylsyringol | 4-Methylsyringol Gentiobioside |

Volatile and glycosylated markers offered at ETS Laboratories

WILDFIRE SMOKE MARKERS IN GRAPES: BASELINE 2021 - 2022

1. Smoke Markers in Grapes and Wines
2. Baseline Levels in Grapes from the US West Coast
3. Comparison with the AWRI Database

BASELINE LEVELS IN GRAPES

**Volatile (free) Guaiacol and 4-Methylguaiacol
ETS experience since 2008:**

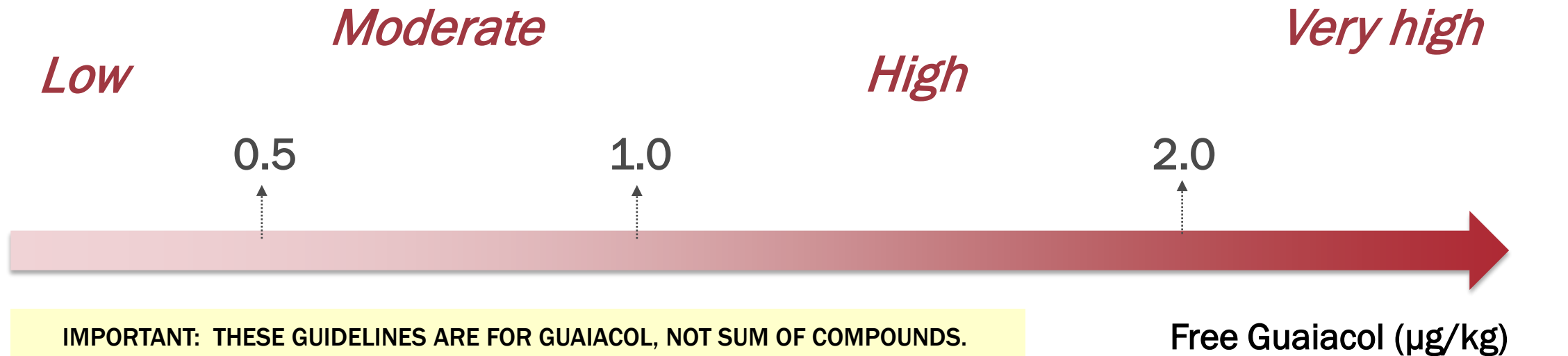
**Non smoke-exposed grapes usually have <0.5 ug/kg
(ETS Minimum Reporting Level), except Syrah and possibly
sometimes Pinot Noir**

Results <0.5 ug/kg in grape samples mean:

- “Negative” test results**
- Low risk of smoke sensory characters in resulting wines**

Interpretation Guidelines for Free Guaiacol in Berries

*Based on our observations so far...
anticipated risk of smoke impact in production wines*:*



IMPORTANT: THESE GUIDELINES ARE FOR GUAIACOL, NOT SUM OF COMPOUNDS.
GUIDELINES ARE SIMPLY OBSERVATIONS BASED UPON PAST EVENTS,
AND MAY OR MAY NOT APPLY TO CURRENT OR FUTURE EVENTS.
ETS DOES NOT, AND WILL NOT, PROPOSE ACCEPTANCE OR REJECTION CRITERIA.

*(*except Syrah)*

BASELINE LEVELS IN GRAPES

Volatile (free) Guaiacol and 4-Methylguaiacol

Other sources, including the AWRI, have reported natural background levels significantly higher than 0.5 ug/kg

Additional volatile markers and glycosylated markers

Reportable levels are expectable, possibly in the majority of samples analyzed

BASELINE LEVELS IN GRAPES

2021 Season:

673 samples (548 samples in AWRI database)

36 grape varieties (nine varieties with >20 samples)

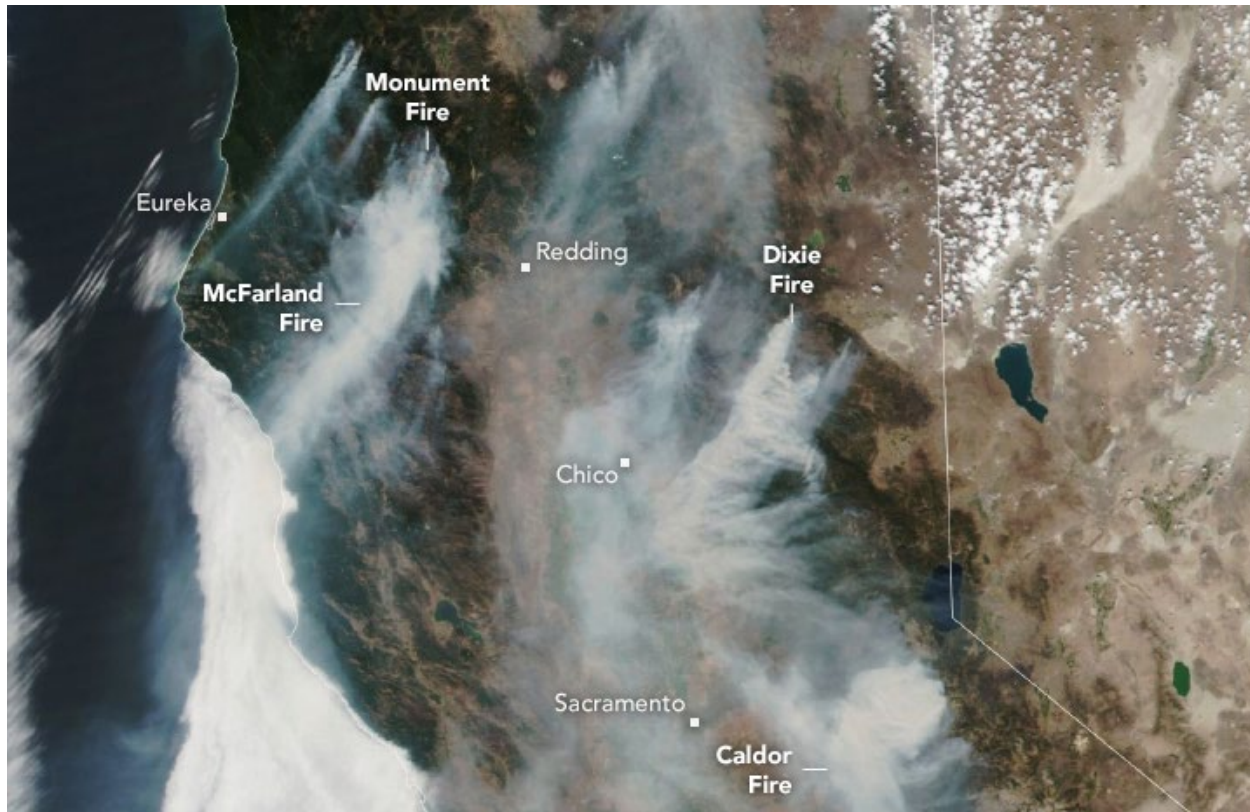
47 AVAs (11 AVA regions)

2022 Season:

229 additional samples

...**902 samples total**

BASELINE LEVELS IN GRAPES



August 19, 2021:

“Shifting winds have begun to darken skies in northern and central California, triggering air quality alerts in [Sacramento](#) and [San Francisco](#).”

Source: NASA Earth Observatory

WARNING: Many AVAs experienced some level of haze during the 2021 and 2022 growing seasons ... are we always observing natural background levels?

| CF 2021-22 (n = 54) | G | 4MG | o-Cre | m-Cre | p-Cre | Cre | Phe | Syr | 4MSyr | G-R | 4MG-R | Cre-R | Phe-R | Syr-G | 4MS-G |
|---------------------|------|------|-------|-------|-------|------|------|------|-------|------|-------|-------|-------|-------|-------|
| median | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 3.0 | 0.0 |
| mean | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 1.3 | 0.0 | 0.0 | 0.1 | 0.1 | 0.8 | 0.3 | 3.7 | 0.0 |
| minimum | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <1.5 | <2.0 | <2.0 | <2.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 |
| maximum | <0.5 | <0.5 | <0.5 | <0.5 | 0.5 | <1.5 | 5.7 | <2.0 | <2.0 | 1.3 | 1.8 | 4.2 | 3.9 | 16.1 | <1.0 |
| 99th percentile | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <1.5 | 5.7 | <2.0 | <2.0 | 1.2 | 1.5 | 4.1 | 3.1 | 15.3 | <1.0 |
| 95th percentile | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <1.5 | 5.2 | <2.0 | <2.0 | <1.0 | 1.1 | 3.4 | 1.4 | 11.5 | <1.0 |
| ≥ MRL (n) | 0 | 0 | 0 | 0 | 1 | 0 | 18 | 0 | 0 | 3 | 5 | 17 | 8 | 39 | 0 |
| ≥ MRL (%) | 0.0 | 0.0 | 0.0 | 0.0 | 1.8 | 0.0 | 32.7 | 0.0 | 0.0 | 5.5 | 9.1 | 30.9 | 14.5 | 70.9 | 0.0 |

volatile markers

glycosylated markers

| CF 2021-22 (n = 54) | G | 4MG | o-Cre | m-Cre | p-Cre | Cre | Phe | Syr | 4MSyr | G-R | 4MG-R | Cre-R | Phe-R | Syr-G | 4MS-G |
|---------------------|------|------|-------|-------|-------|------|------|------|-------|------|-------|-------|-------|-------|-------|
| median | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 3.0 | 0.0 |
| mean | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 1.3 | 0.0 | 0.0 | 0.1 | 0.1 | 0.8 | 0.3 | 3.7 | 0.0 |
| minimum | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <1.5 | <2.0 | <2.0 | <2.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 |
| maximum | <0.5 | <0.5 | <0.5 | <0.5 | 0.5 | <1.5 | 5.7 | <2.0 | <2.0 | 1.3 | 1.8 | 4.2 | 3.9 | 16.1 | <1.0 |
| 99th percentile | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <1.5 | 5.7 | <2.0 | <2.0 | 1.2 | 1.5 | 4.1 | 3.1 | 15.3 | <1.0 |
| 95th percentile | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <1.5 | 5.2 | <2.0 | <2.0 | <1.0 | 1.1 | 3.4 | 1.4 | 11.5 | <1.0 |
| ≥ MRL (n) | 0 | 0 | 0 | 0 | 1 | 0 | 18 | 0 | 0 | 3 | 5 | 17 | 8 | 39 | 0 |
| ≥ MRL (%) | 0.0 | 0.0 | 0.0 | 0.0 | 1.8 | 0.0 | 32.7 | 0.0 | 0.0 | 5.5 | 9.1 | 30.9 | 14.5 | 70.9 | 0.0 |

statistics

volatile markers

glycosylated markers

| CF 2021-22 (n = 54) | G | 4MG | o-Cre | m-Cre | p-Cre | Cre | Phe | Syr | 4MSyr | G-R | 4MG-R | Cre-R | Phe-R | Syr-G | 4MS-G |
|---------------------|------|------|-------|-------|-------|------|------|------|-------|------|-------|-------|-------|-------|-------|
| median | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 3.0 | 0.0 |
| mean | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 1.3 | 0.0 | 0.0 | 0.1 | 0.1 | 0.8 | 0.3 | 3.7 | 0.0 |
| minimum | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <1.5 | <2.0 | <2.0 | <2.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 |
| maximum | <0.5 | <0.5 | <0.5 | <0.5 | 0.5 | <1.5 | 5.7 | <2.0 | <2.0 | 1.3 | 1.8 | 4.2 | 3.9 | 16.1 | <1.0 |
| 99th percentile | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <1.5 | 5.7 | <2.0 | <2.0 | 1.2 | 1.5 | 4.1 | 3.1 | 15.3 | <1.0 |
| 95th percentile | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <1.5 | 5.2 | <2.0 | <2.0 | <1.0 | 1.1 | 3.4 | 1.4 | 11.5 | <1.0 |
| ≥ MRL (n) | 0 | 0 | 0 | 0 | 1 | 0 | 19 | 0 | 0 | 3 | 5 | 17 | 8 | 20 | 0 |
| ≥ MRL (%) | 0.0 | 0.0 | 0.0 | 0.0 | 1.8 | 0.0 | 32.7 | 0.0 | 0.0 | 5.5 | 9.1 | 30.9 | 14.5 | 70.9 | 0.0 |

statistics

volatile markers

glycosylated markers

| CF 2021-22 (n = 54) | G | 4MG | o-Cre | m-Cre | p-Cre | Cre | Phe | Syr | 4MSyr | G-R | 4MG-R | Cre-R | Phe-R | Syr-G | 4MS-G |
|---------------------|------|------|-------|-------|-------|------|------|------|-------|------|-------|-------|-------|-------|-------|
| median | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 3.0 | 0.0 |
| mean | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 1.3 | 0.0 | 0.0 | 0.1 | 0.1 | 0.8 | 0.3 | 3.7 | 0.0 |
| minimum | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <1.5 | <2.0 | <2.0 | <2.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 |
| maximum | <0.5 | <0.5 | <0.5 | <0.5 | 0.5 | <1.5 | 5.7 | <2.0 | <2.0 | 1.3 | 1.8 | 4.2 | 3.9 | 16.1 | <1.0 |
| 99th percentile | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <1.5 | 5.7 | <2.0 | <2.0 | 1.2 | 1.5 | 4.1 | 3.1 | 15.3 | <1.0 |
| 95th percentile | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <1.5 | 5.2 | <2.0 | <2.0 | <1.0 | 1.1 | 3.4 | 1.4 | 11.5 | <1.0 |
| ≥ MRL (%) | 0 | 0 | 0 | 0 | 1 | 0 | 18 | 0 | 0 | 3 | 5 | 17 | 8 | 39 | 0 |
| ≥ MRL (%) | 0.0 | 0.0 | 0.0 | 0.0 | 1.8 | 0.0 | 32.7 | 0.0 | 0.0 | 5.5 | 9.1 | 30.9 | 14.5 | 70.9 | 0.0 |

The AWRI utilizes 99th percentile values in order to establish evidence of exposure to smoke

Based on the need to balance false negative and false positive interpretations:

- . “False negative interpretations could lead to the production of smoke-tainted wine”
- . “False positive interpretation could lead to the rejection of ‘clean’ grapes and loss of product and associated income.”

| CF 2021-22 (n = 54) | G | 4MG | o-Cre | m-Cre | p-Cre | Cre | Phe | Syr | 4MSyr | G-R | 4MG-R | Cre-R | Phe-R | Syr-G | 4MS-G |
|---------------------|------|------|-------|-------|-------|------|------|------|-------|------|-------|-------|-------|-------|-------|
| median | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 3.0 | 0.0 |
| mean | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 1.3 | 0.0 | 0.0 | 0.1 | 0.1 | 0.8 | 0.3 | 3.7 | 0.0 |
| minimum | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <1.5 | <2.0 | <2.0 | <2.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 |
| maximum | <0.5 | <0.5 | <0.5 | <0.5 | 0.5 | <1.5 | 5.7 | <2.0 | <2.0 | 1.3 | 1.8 | 4.2 | 3.9 | 16.1 | <1.0 |
| 99th percentile | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <1.5 | 5.7 | <2.0 | <2.0 | 1.2 | 1.5 | 4.1 | 3.1 | 15.3 | <1.0 |
| 95th percentile | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <1.5 | 5.2 | <2.0 | <2.0 | <1.0 | 1.1 | 3.4 | 1.4 | 11.5 | <1.0 |
| ≥ MRL (%) | 0 | 0 | 0 | 0 | 1 | 0 | 18 | 0 | 0 | 3 | 5 | 17 | 8 | 39 | 0 |
| ≥ MRL (%) | 0.0 | 0.0 | 0.0 | 0.0 | 1.8 | 0.0 | 32.7 | 0.0 | 0.0 | 5.5 | 9.1 | 30.9 | 14.5 | 70.9 | 0.0 |

ETS Laboratories Position

Descriptive statistics such as 99th percentile values (or other percentile values) are provided for comparison purposes, but ETS cannot, and will not, draw the lines between the risks of false negative vs. false positive interpretations.

In our view, such interpretations should be made by our clients, who are best positioned to weigh the risks of producing smoke-impacted wines vs. rejecting ‘clean’ grapes.

It is advisable to develop your own background data during non-smoke years, especially with Pinot Noir.

| CF 2021-22 (n = 54) | G | 4MG | o-Cre | m-Cre | p-Cre | Cre | Phe | Syr | 4MSyr | G-R | 4MG-R | Cre-R | Phe-R | Syr-G | 4MS-G |
|---------------------|------|------|-------|-------|-------|------|------|------|-------|------|-------|-------|-------|-------|-------|
| median | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 3.0 | 0.0 |
| mean | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 1.3 | 0.0 | 0.0 | 0.1 | 0.1 | 0.8 | 0.3 | 3.7 | 0.0 |
| minimum | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <1.5 | <2.0 | <2.0 | <2.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 |
| maximum | <0.5 | <0.5 | <0.5 | <0.5 | 0.5 | <1.5 | 5.7 | <2.0 | <2.0 | 1.3 | 1.8 | 4.2 | 3.9 | 16.1 | <1.0 |
| 99th percentile | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <1.5 | 5.7 | <2.0 | <2.0 | 1.2 | 1.5 | 4.1 | 3.1 | 15.3 | <1.0 |
| 95th percentile | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <1.5 | 5.2 | <2.0 | <2.0 | <1.0 | 1.1 | 3.4 | 1.4 | 11.5 | <1.0 |
| ≥ MRL (n) | 0 | 0 | 0 | 0 | 1 | 0 | 18 | 0 | 0 | 3 | 5 | 17 | 8 | 39 | 0 |
| ≥ MRL (%) | 0.0 | 0.0 | 0.0 | 0.0 | 1.8 | 0.0 | 32.7 | 0.0 | 0.0 | 5.5 | 9.1 | 30.9 | 14.5 | 70.9 | 0.0 |

| ME 2021-22 (n = 55) | G | 4MG | o-Cre | m-Cre | p-Cre | Cre | Phe | Syr | 4MSyr | G-R | 4MG-R | Cre-R | Phe-R | Syr-G | 4MS-G |
|---------------------|------|------|-------|-------|-------|------|------|------|-------|------|-------|-------|-------|-------|-------|
| median | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 1.5 | 0.0 |
| mean | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 1.0 | 0.0 | 0.0 | 0.0 | 0.1 | 0.9 | 0.4 | 2.1 | 0.1 |
| minimum | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <1.5 | <2.0 | <2.0 | <2.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 |
| maximum | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <1.5 | 7.1 | <2.0 | <2.0 | 1.3 | 2.2 | 5.1 | 6.5 | 10.5 | 1.7 |
| 99th percentile | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <1.5 | 6.1 | <2.0 | <2.0 | <1.0 | 1.8 | 4.5 | 4.8 | 10.4 | 1.4 |
| 95th percentile | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <1.5 | 4.3 | <2.0 | <2.0 | <1.0 | 1.3 | 3.9 | 1.6 | 6.4 | 0.3 |
| ≥ MRL (n) | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 17.0 | 0.0 | 0.0 | 1.0 | 5.0 | 22.0 | 12.0 | 36.0 | 3.0 |
| ≥ MRL (%) | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 30.9 | 0.0 | 0.0 | 1.8 | 9.1 | 40.0 | 21.8 | 65.5 | 5.5 |

| CF 2021-22 (n = 54) | G | 4MG | o-Cre | m-Cre | p-Cre | Cre | Phe | Syr | 4MSyr | G-R | 4MG-R | Cre-R | Phe-R | Syr-G | 4MS-G |
|---------------------|------|------|-------|-------|-------|------|------|------|-------|------|-------|-------|-------|-------|-------|
| median | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 3.0 | 0.0 |
| mean | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 1.3 | 0.0 | 0.0 | 0.1 | 0.1 | 0.8 | 0.3 | 3.7 | 0.0 |
| minimum | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <1.5 | <2.0 | <2.0 | <2.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 |
| maximum | <0.5 | <0.5 | <0.5 | <0.5 | 0.5 | <1.5 | 5.7 | <2.0 | <2.0 | 1.3 | 1.8 | 4.2 | 3.9 | 16.1 | <1.0 |
| 99th percentile | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <1.5 | 5.7 | <2.0 | <2.0 | 1.2 | 1.5 | 4.1 | 3.1 | 15.3 | <1.0 |
| 95th percentile | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <1.5 | 5.2 | <2.0 | <2.0 | <1.0 | 1.1 | 3.4 | 1.4 | 11.5 | <1.0 |
| ≥ MRL (n) | 0 | 0 | 0 | 0 | 1 | 0 | 18 | 0 | 0 | 3 | 5 | 17 | 8 | 39 | 0 |
| ≥ MRL (%) | 0.0 | 0.0 | 0.0 | 0.0 | 1.8 | 0.0 | 32.7 | 0.0 | 0.0 | 5.5 | 9.1 | 30.9 | 14.5 | 70.9 | 0.0 |

| ME 2021-22 (n = 55) | G | 4MG | o-Cre | m-Cre | p-Cre | Cre | Phe | Syr | 4MSyr | G-R | 4MG-R | Cre-R | Phe-R | Syr-G | 4MS-G |
|---------------------|------|------|-------|-------|-------|------|------|------|-------|------|-------|-------|-------|-------|-------|
| median | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 1.5 | 0.0 |
| mean | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 1.0 | 0.0 | 0.0 | 0.0 | 0.1 | 0.9 | 0.4 | 2.1 | 0.1 |
| minimum | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <1.5 | <2.0 | <2.0 | <2.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 |
| maximum | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <1.5 | 7.1 | <2.0 | <2.0 | 1.3 | 2.2 | 5.1 | 6.5 | 10.5 | 1.7 |
| 99th percentile | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <1.5 | 6.1 | <2.0 | <2.0 | <1.0 | 1.8 | 4.5 | 4.8 | 10.4 | 1.4 |
| 95th percentile | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <1.5 | 4.3 | <2.0 | <2.0 | <1.0 | 1.3 | 3.9 | 1.6 | 6.4 | 0.3 |
| ≥ MRL (n) | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 17.0 | 0.0 | 0.0 | 1.0 | 5.0 | 22.0 | 12.0 | 36.0 | 3.0 |
| ≥ MRL (%) | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 30.9 | 0.0 | 0.0 | 1.8 | 9.1 | 40.0 | 21.8 | 65.5 | 5.5 |

| CS 2021-22 (n = 338) | G | 4MG | o-Cre | m-Cre | p-Cre | Cre | Phe | Syr | 4MSyr | G-R | 4MG-R | Cre-R | Phe-R | Syr-G | 4MS-G |
|----------------------|------|------|-------|-------|-------|------|------|------|-------|------|-------|-------|-------|-------|-------|
| median | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 1.7 | 0.0 |
| mean | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 1.0 | 0.0 | 0.0 | 0.1 | 0.1 | 0.9 | 0.9 | 1.8 | 0.0 |
| minimum | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <1.5 | <2.0 | <2.0 | <2.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 |
| maximum | 0.5 | <0.5 | 1.1 | <0.5 | 0.9 | <1.5 | 9.9 | 7.9 | <2.0 | 1.9 | 3.0 | 6.8 | 8.6 | 8.7 | 1.2 |
| 99th percentile | <0.5 | <0.5 | 0.8 | <0.5 | 0.8 | <1.5 | 7.5 | <2.0 | <2.0 | <1.0 | 1.8 | 4.9 | 5.1 | 6.4 | 0.6 |
| 95th percentile | <0.5 | <0.5 | 0.5 | <0.5 | <0.5 | <1.5 | 5.1 | <2.0 | <2.0 | <1.0 | 1.2 | 3.4 | 2.5 | 4.9 | <1.0 |
| ≥ MRL (n) | 1 | 0 | 23 | 0 | 11 | 0 | 101 | 2 | 1 | 19 | 34 | 139 | 159 | 206 | 4 |
| ≥ MRL (%) | 0.3 | 0.0 | 6.8 | 0.0 | 3.3 | 0.0 | 30.1 | 0.6 | 0.3 | 5.6 | 9.9 | 40.6 | 46.5 | 60.2 | 1.2 |

| CF 2021-22 (n = 54) | G | 4MG | o-Cre | m-Cre | p-Cre | Cre | Phe | Syr | 4MSyr | G-R | 4MG-R | Cre-R | Phe-R | Syr-G | 4MS-G |
|---------------------|------|------|-------|-------|-------|------|------|------|-------|------|-------|-------|-------|-------|-------|
| median | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 3.0 | 0.0 |
| mean | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 1.3 | 0.0 | 0.0 | 0.1 | 0.1 | 0.8 | 0.3 | 3.7 | 0.0 |
| minimum | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <1.5 | <2.0 | <2.0 | <2.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 |
| maximum | <0.5 | <0.5 | <0.5 | <0.5 | 0.5 | <1.5 | 5.7 | <2.0 | <2.0 | 1.3 | 1.8 | 4.2 | 3.9 | 16.1 | <1.0 |
| 99th percentile | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <1.5 | 5.7 | <2.0 | <2.0 | 1.2 | 1.5 | 4.1 | 3.1 | 15.3 | <1.0 |
| 95th percentile | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <1.5 | 5.2 | <2.0 | <2.0 | <1.0 | 1.1 | 3.4 | 1.4 | 11.5 | <1.0 |
| ≥ MRL (n) | 0 | 0 | 0 | 0 | 1 | 0 | 18 | 0 | 0 | 3 | 5 | 17 | 8 | 39 | 0 |
| ≥ MRL (%) | 0.0 | 0.0 | 0.0 | 0.0 | 1.8 | 0.0 | 32.7 | 0.0 | 0.0 | 5.5 | 9.1 | 30.9 | 14.5 | 70.9 | 0.0 |

| ME 2021-22 (n = 55) | G | 4MG | o-Cre | m-Cre | p-Cre | Cre | Phe | Syr | 4MSyr | G-R | 4MG-R | Cre-R | Phe-R | Syr-G | 4MS-G |
|---------------------|------|------|-------|-------|-------|-----|-----|-----|-------|-----|-------|-------|-------|-------|-------|
| median | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 1.5 | 0.0 |
| mean | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 1.0 | 0.0 | 0.0 | 0.0 | 0.1 | 0.9 | 0.4 | 2.1 | 0.1 |
| minimum | <0.5 | <0.5 | <0.5 | | | | | | | | | | <1.0 | <1.0 | <1.0 |
| maximum | <0.5 | <0.5 | <0.5 | | | | | | | | | | 6.5 | 10.5 | 1.7 |
| 99th percentile | <0.5 | <0.5 | <0.5 | | | | | | | | | | 4.8 | 10.4 | 1.4 |
| 95th percentile | <0.5 | <0.5 | <0.5 | | | | | | | | | | 1.6 | 6.4 | 0.3 |
| ≥ MRL (n) | 0.0 | 0.0 | 0.0 | | | | | | | | | | 12.0 | 36.0 | 3.0 |
| ≥ MRL (%) | 0.0 | 0.0 | 0.0 | | | | | | | | | | 21.8 | 65.5 | 5.5 |

Note the extreme rarity of reportable results for guaiacol

| CS 2021-22 (n = 338) | G | 4MG | o-Cre | m-Cre | p-Cre | Cre | Phe | Syr | 4MSyr | G-R | 4MG-R | Cre-R | Phe-R | Syr-G | 4MS-G |
|----------------------|------|------|-------|-------|-------|------|------|------|-------|------|-------|-------|-------|-------|-------|
| median | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 1.7 | 0.0 |
| mean | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 1.0 | 0.0 | 0.0 | 0.1 | 0.1 | 0.9 | 0.9 | 1.8 | 0.0 |
| minimum | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <1.5 | <2.0 | <2.0 | <2.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 |
| maximum | 0.5 | <0.5 | 1.1 | <0.5 | 0.9 | <1.5 | 9.9 | 7.9 | <2.0 | 1.9 | 3.0 | 6.8 | 8.6 | 8.7 | 1.2 |
| 99th percentile | <0.5 | <0.5 | 0.8 | <0.5 | 0.8 | <1.5 | 7.5 | <2.0 | <2.0 | <1.0 | 1.8 | 4.9 | 5.1 | 6.4 | 0.6 |
| 95th percentile | <0.5 | <0.5 | 0.5 | <0.5 | <0.5 | <1.5 | 5.1 | <2.0 | <2.0 | <1.0 | 1.2 | 3.4 | 2.5 | 4.9 | <1.0 |
| ≥ MRL (n) | 1 | 0 | 23 | 0 | 11 | 0 | 101 | 2 | 1 | 19 | 34 | 139 | 159 | 206 | 4 |
| ≥ MRL (%) | 0.3 | 0.0 | 6.8 | 0.0 | 3.3 | 0.0 | 30.1 | 0.6 | 0.3 | 5.6 | 9.9 | 40.6 | 46.5 | 60.2 | 1.2 |

| PV 2021-22 (n = 40) | G | 4MG | o-Cre | m-Cre | p-Cre | Cre | Phe | Syr | 4MSyr | G-R | 4MG-R | Cre-R | Phe-R | Syr-G | 4MS-G |
|---------------------|------|------|-------|-------|-------|------|------|------|-------|------|-------|-------|-------|-------|-------|
| median | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 1.6 | 0.0 | 0.0 | 2.2 | 0.0 |
| mean | 0.1 | 0.0 | 0.0 | 0.0 | 0.1 | 0.0 | 1.9 | 0.0 | 0.0 | 0.1 | 1.4 | 0.6 | 1.9 | 3.0 | 0.0 |
| minimum | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <1.5 | <2.0 | <2.0 | <2.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 |
| maximum | 0.8 | <0.5 | <0.5 | <0.5 | 0.9 | <1.5 | 9.6 | <2.0 | <2.0 | 1.8 | 5.3 | 4.5 | 15.1 | 13.3 | 1.5 |
| 99th percentile | 0.8 | <0.5 | <0.5 | <0.5 | 0.9 | <1.5 | 8.5 | <2.0 | <2.0 | 1.6 | 4.8 | 4.4 | 14.6 | 11.9 | <1.0 |
| 95th percentile | 0.7 | <0.5 | <0.5 | <0.5 | 0.7 | <1.5 | 6.0 | <2.0 | <2.0 | <1.0 | 2.7 | 2.6 | 9.4 | 9.5 | <1.0 |
| ≥ MRL (n) | 9 | 0 | 0 | 0 | 6 | 0 | 20 | 0 | 0 | 3 | 28 | 12 | 18 | 29 | 1 |
| ≥ MRL (%) | 22.5 | 0.0 | 0.0 | 0.0 | 15.0 | 0.0 | 50.0 | 0.0 | 0.0 | 7.1 | 66.7 | 28.6 | 42.9 | 69.0 | 2.4 |

Low but reportable levels of guaiacol and p-cresol in a few Petit Verdot samples

... native levels or influence of light smoke?

| PV 2021-22 (n = 40) | G | 4MG | o-Cre | m-Cre | p-Cre | Cre | Phe | Syr | 4MSyr | G-R | 4MG-R | Cre-R | Phe-R | Syr-G | 4MS-G |
|---------------------|------|------|-------|-------|-------|------|------|------|-------|------|-------|-------|-------|-------|-------|
| median | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 1.6 | 0.0 | 0.0 | 2.2 | 0.0 |
| mean | 0.1 | 0.0 | 0.0 | 0.0 | 0.1 | 0.0 | 1.9 | 0.0 | 0.0 | 0.1 | 1.4 | 0.6 | 1.9 | 3.0 | 0.0 |
| minimum | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <1.5 | <2.0 | <2.0 | <2.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 |
| maximum | 0.8 | <0.5 | <0.5 | <0.5 | 0.9 | <1.5 | 9.6 | <2.0 | <2.0 | 1.8 | 5.3 | 4.5 | 15.1 | 13.3 | 1.5 |
| 99th percentile | 0.8 | <0.5 | <0.5 | <0.5 | 0.9 | <1.5 | 8.5 | <2.0 | <2.0 | 1.6 | 4.8 | 4.4 | 14.6 | 11.9 | <1.0 |
| 95th percentile | 0.7 | <0.5 | <0.5 | <0.5 | 0.7 | <1.5 | 6.0 | <2.0 | <2.0 | <1.0 | 2.7 | 2.6 | 9.4 | 9.5 | <1.0 |
| ≥ MRL (n) | 9 | 0 | 0 | 0 | 6 | 0 | 20 | 0 | 0 | 3 | 28 | 12 | 18 | 29 | 1 |
| ≥ MRL (%) | 22.5 | 0.0 | 0.0 | 0.0 | 15.0 | 0.0 | 50.0 | 0.0 | 0.0 | 7.1 | 66.7 | 28.6 | 42.9 | 69.0 | 2.4 |

| SY 2021-22 (n = 22) | G | 4MG | o-Cre | m-Cre | p-Cre | Cre | Phe | Syr | 4MSyr | G-R | 4MG-R | Cre-R | Phe-R | Syr-G | 4MS-G |
|---------------------|------|------|-------|-------|-------|------|------|------|-------|------|-------|-------|-------|-------|-------|
| median | 1.4 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 1.7 | 1.1 | 0.5 | 0.0 | 2.4 | 0.0 |
| mean | 1.7 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 1.7 | 0.2 | 0.1 | 1.9 | 1.1 | 1.5 | 0.2 | 3.6 | 0.2 |
| minimum | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <1.5 | <2.0 | <2.0 | <2.0 | 1.6 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 |
| maximum | 5.6 | <0.5 | 0.5 | <0.5 | <0.5 | <1.5 | 6.3 | 4.0 | 2.7 | 5.0 | 5.2 | 7.1 | 2.6 | 10.8 | 1.6 |
| 99th percentile | 5.4 | <0.5 | <0.5 | <0.5 | <0.5 | <1.5 | 6.3 | 3.1 | 2.1 | 4.8 | 4.7 | 7.0 | 2.4 | 10.3 | 1.5 |
| 95th percentile | 4.7 | <0.5 | <0.5 | <0.5 | <0.5 | <1.5 | 6.0 | <2.0 | <2.0 | 4.0 | 2.9 | 6.2 | 1.7 | 8.7 | 1.2 |
| ≥ MRL (n) | 19 | 0 | 1 | 0 | 0 | 0 | 10 | 1 | 1 | 19 | 14 | 12 | 3 | 17 | 4 |
| ≥ MRL (%) | 79.2 | 0.0 | 4.2 | 0.0 | 0.0 | 0.0 | 41.7 | 4.2 | 4.2 | 79.2 | 53.8 | 46.2 | 11.5 | 65.4 | 15.4 |

Guaiacol and guaiacol rutinoside reportable in a large majority of Syrah samples (expected with this variety).

| PN 2021-22 (n = 161) | G | 4MG | o-Cre | m-Cre | p-Cre | Cre | Phe | Syr | 4MSyr | G-R | 4MG-R | Cre-R | Phe-R | Syr-G | 4MS-G |
|----------------------|------|------|-------|-------|-------|------|------|------|-------|------|-------|-------|-------|-------|-------|
| median | 0.0 | 0.0 | 0.6 | 0.0 | 0.0 | 0.0 | 2.1 | <2.0 | <2.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| mean | 0.1 | 0.0 | 0.6 | 0.0 | 0.4 | 0.6 | 2.3 | <2.0 | <2.0 | 0.1 | 0.3 | 0.8 | 1.4 | 0.8 | 0.0 |
| minimum | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <1.5 | <2.0 | <2.0 | <2.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 |
| maximum | 1.4 | <0.5 | 1.9 | 1.7 | 2.4 | 4.6 | 10.4 | <2.0 | 2.3 | 2.1 | 2.9 | 9.2 | 18.0 | 5.1 | 2.4 |
| 99th percentile | 1.0 | <0.5 | 1.6 | <0.5 | 2.2 | 3.1 | 9.7 | <2.0 | <2.0 | 1.2 | 2.0 | 4.8 | 15.7 | 4.5 | 1.4 |
| 95th percentile | 0.7 | <0.5 | 1.4 | <0.5 | 1.6 | 2.5 | 7.6 | <2.0 | <2.0 | <1.0 | 1.7 | 3.1 | 7.7 | 3.1 | <1.0 |
| ≥ MRL (n) | 25 | 0 | 107 | 2 | 67 | 43 | 71 | 0 | 1 | 8 | 33 | 60 | 47 | 61 | 5 |
| ≥ MRL (%) | 15.5 | 0.0 | 66.5 | 1.2 | 41.6 | 26.7 | 44.1 | 0.0 | 0.6 | 4.8 | 19.8 | 35.9 | 28.1 | 36.5 | 3.0 |

Guaiacol reportable in ~15% of the Pinot Noir samples
o-Cresol and p-Cresol very often reportable
... native levels or influence of light smoke?

A third year of data is highly desirable

| PN 2021-22 (n = 161) | G | 4MG | o-Cre | m-Cre | p-Cre | Cre | Phe | Syr | 4MSyr | G-R | 4MG-R | Cre-R | Phe-R | Syr-G | 4MS-G |
|----------------------|------|------|-------|-------|-------|------|------|------|-------|------|-------|-------|-------|-------|-------|
| median | 0.0 | 0.0 | 0.6 | 0.0 | 0.0 | 0.0 | 2.1 | <2.0 | <2.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| mean | 0.1 | 0.0 | 0.6 | 0.0 | 0.4 | 0.6 | 2.3 | <2.0 | <2.0 | 0.1 | 0.3 | 0.8 | 1.4 | 0.8 | 0.0 |
| minimum | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <1.5 | <2.0 | <2.0 | <2.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 |
| maximum | 1.4 | <0.5 | 1.9 | 1.7 | 2.4 | 4.6 | 10.4 | <2.0 | 2.3 | 2.1 | 2.9 | 9.2 | 18.0 | 5.1 | 2.4 |
| 99th percentile | 1.0 | <0.5 | 1.6 | <0.5 | 2.2 | 3.1 | 9.7 | <2.0 | <2.0 | 1.2 | 2.0 | 4.8 | 15.7 | 4.5 | 1.4 |
| 95th percentile | 0.7 | <0.5 | 1.4 | <0.5 | 1.6 | 2.5 | 7.6 | <2.0 | <2.0 | <1.0 | 1.7 | 3.1 | 7.7 | 3.1 | <1.0 |
| ≥ MRL (n) | 25 | 0 | 107 | 2 | 67 | 43 | 71 | 0 | 1 | 8 | 33 | 60 | 47 | 61 | 5 |
| ≥ MRL (%) | 15.5 | 0.0 | 66.5 | 1.2 | 41.6 | 26.7 | 44.1 | 0.0 | 0.6 | 4.8 | 19.8 | 35.9 | 28.1 | 36.5 | 3.0 |

| CH 2021-22 (n = 76) | G | 4MG | o-Cre | m-Cre | p-Cre | Cre | Phe | Syr | 4MSyr | G-R | 4MG-R | Cre-R | Phe-R | Syr-G | 4MS-G |
|---------------------|------|------|-------|-------|-------|------|------|------|-------|------|-------|-------|-------|-------|-------|
| median | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| mean | 0.0 | 0.0 | 0.6 | 0.0 | 0.7 | 0.5 | 3.4 | 0.0 | 0.0 | 0.0 | 0.8 | 0.9 | 0.4 | 0.4 | 0.0 |
| minimum | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <1.5 | <2.0 | <2.0 | <2.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 |
| maximum | 0.6 | <0.5 | 1.0 | <0.5 | 1.2 | 2.2 | 11.5 | <2.0 | 2.4 | <1.0 | 2.1 | 4.9 | 12.3 | 1.3 | <1.0 |
| 99th percentile | <0.5 | <0.5 | <0.5 | <0.5 | 1.2 | <1.5 | 8.0 | <2.0 | 2.4 | <1.0 | 1.8 | 4.3 | 7.3 | 1.3 | <1.0 |
| 95th percentile | <0.5 | <0.5 | <0.5 | <0.5 | 1.1 | <1.5 | 5.3 | <2.0 | <2.0 | <1.0 | 1.4 | 1.9 | 1.8 | <1.0 | <1.0 |
| ≥ MRL (n) | 1 | 0 | 7 | 0 | 11 | 4 | 26 | 0 | 2 | 0 | 9 | 9 | 7 | 4 | 0 |
| ≥ MRL (%) | 1.3 | 0.0 | 9.2 | 0.0 | 14.5 | 5.3 | 34.2 | 0.0 | 2.6 | 0.0 | 11.8 | 11.8 | 9.2 | 5.3 | 0.0 |

Guaiacol very rarely reportable in Chardonnay
Glycosylated markers particularly low

WILDFIRE SMOKE MARKERS IN GRAPES: BASELINE 2021 - 2022

1. Smoke Markers in Grapes and Wines
2. Baseline Levels in Grapes from the US West Coast
3. Comparison with the AWRI Database

Original Article **Open Access**

Concentration of smoke marker compounds in non-smoke-exposed grapes and wine in Australia

A. Coulter , G. Baldock, M. Parker, Y. Hayasaka, I.L. Francis, M. Herderich

First published: 16 February 2022 | <https://doi.org/10.1111/ajgw.12543>

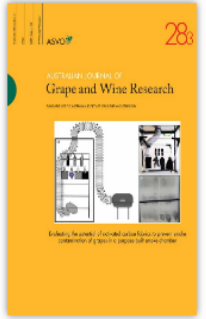
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Abstract

Background and Aims

An elevated concentration of several volatile phenols and their glycosides in grapes and wines is associated with exposure of grapes to forest fire smoke. Interpretation of phenol compositional data from grapes or wines, however, is complicated by the fact that traces of these compounds can be detected in non-smoke-exposed samples. Hence, the concentration of smoke marker compounds was investigated with the aim of providing a reference data set to help determine smoke exposure.



Volume 28, Issue 3
July 2022
Pages 459-474

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Table 3. Descriptive statistics for the grape samples from the seven red cultivars: Median, 95% confidence interval for the median, interquartile range, maximum and 99th percentile values for the concentration of seven volatile phenol and six phenolic glycoside compounds in non-smoke exposed grapes.

| Cultivar | Variable | Concentration (µg/kg) | | | | | | | | | | | | |
|-------------------------------------|-------------------|-----------------------|---------|---------|---------|---------|---------|---------|---------|----------------|---------|----------------|----------------|---------|
| | | SyGG | MSyGG | PhRG | CrRG | GuRG | MGuRG | MeGu | Gu | <i>m</i> -Cres | MeSyr | <i>o</i> -Cres | <i>p</i> -Cres | Syr |
| Cabernet Sauvignon (<i>n</i> = 44) | Median | 1.7 | 0.4 | 0.5 | 1.3 | 0.5 | 0.7 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | 95% CI for median | 1.4–2.1 | 0.4–0.5 | 0.3–0.7 | 1.1–1.5 | 0.5–0.6 | 0.6–1.1 | n.a. | n.a. | n.a. | n.a. | n.a. | n.a. | n.a. |
| | IQR | 1.4 | 0.3 | 0.7 | 0.8 | 0.3 | 0.8 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | Maximum | 7.9 | 1.3 | 2.6 | 3.6 | 2.3 | 4.0 | 0.2 | 2.9 | 1.0 | 0.0 | 2.8 | 0.0 | 0.0 |
| | 99th percentile | 7.6 | 1.1 | 2.5 | 3.6 | 2.2 | 3.9 | 1.0 | 2.9 | 1.0 | 2.0 | 2.8 | 1.0 | 2.0 |
| Grenache (<i>n</i> = 44) | Median | 2.4 | 0.4 | 0.6 | 2.2 | 0.7 | 0.6 | 0.2 | 0.6 | 0.1 | 0.3 | 1.0 | 0.1 | 0.3 |
| | 95% CI for median | 2.0–2.9 | 0.3–0.5 | 0.5–0.8 | 1.7–2.6 | 0.5–0.8 | 0.4–0.7 | 0.2–0.2 | 0.5–0.8 | 0.1–0.1 | 0.2–0.3 | 0.9–1.2 | 0.1–0.1 | 0.3–0.4 |
| | IQR | 2.4 | 0.3 | 0.6 | 1.5 | 0.4 | 0.4 | 0.2 | 0.6 | 0.0 | 0.3 | 0.5 | 0.1 | 0.3 |
| | Maximum | 14.7 | 4.5 | 2.1 | 5.8 | 9.1 | 4.7 | 0.2 | 9.0 | 0.1 | 0.3 | 5.0 | 0.1 | 0.5 |
| | 99th percentile | 12.3 | 4.5 | 2.0 | 5.2 | 8.8 | 4.7 | 1.0 | 8.0 | 1.0 | 2.0 | 4.3 | 1.0 | 2.0 |

Glycosylated markers - AWRI and ETS

results are quite similar despite:

- Possible influence of August 2021 and 2022 haze
- AWRI results expressed as syringol gentiobioside equivalents instead of “true” concentrations

| | | | | | | | | | | | | | | |
|-------------------------|-------------------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|
| Shiraz (<i>n</i> = 67) | 99th percentile | 2.8 | 1.0 | 1.0 | 3.7 | 1.3 | 1.0 | 1.0 | 2.8 | 1.0 | 2.0 | 1.6 | 1.0 | 2.0 |
| | Median | 4.6 | 1.2 | 0.3 | 2.2 | 2.4 | 1.3 | 0.0 | 3.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | 95% CI for median | 3.8–5.7 | 1.0–1.4 | 0.2–0.4 | 1.6–2.4 | 2.1–3.1 | 1.1–1.5 | 0.0–0.0 | 2.0–3.0 | 0.0–0.0 | 0.0–0.0 | 0.0–0.9 | 0.0–0.0 | 0.0–0.0 |
| | IQR | 4.1 | 0.9 | 0.4 | 1.6 | 2.0 | 0.9 | 0.0 | 2.0 | 0.0 | 0.0 | 1.6 | 0.0 | 0.0 |
| | Maximum | 14.7 | 4.5 | 2.1 | 5.8 | 9.1 | 4.7 | 0.2 | 9.0 | 0.1 | 0.3 | 5.0 | 0.1 | 0.5 |
| | 99th percentile | 12.3 | 4.5 | 2.0 | 5.2 | 8.8 | 4.7 | 1.0 | 8.0 | 1.0 | 2.0 | 4.3 | 1.0 | 2.0 |

Values in italics indicate that the 99th percentile value has been adjusted up to the limit of quantification of the method; n.a., not applicable. CI, confidence interval; CrRG, cresol rutinoside; Gu, guaiacol; GuRG, guaiacol rutinoside; IQR, interquartile range; *m*-Cres, *m*-cresol; MeGu, 4-methylguaiaicol; MeSyr, 4-methylsyringol; MGuRG, methylguaiaicol rutinoside; MSyGG, methylsyringol gentiobioside; *o*-Cres, *o*-cresol; *p*-Cres, *p*-cresol; PhRG, phenol rutinoside; SyGG, syringol gentiobioside; Syr, syringol.

Table 3. Descriptive statistics for the grape samples from the seven red cultivars: Median, 95% confidence interval for the median, interquartile range, maximum and 99th percentile values for the concentration of seven volatile phenol and six phenolic glycoside compounds in non-smoked grapes.

| Cultivar | Variable | Concentration (µg/kg) | | | | | | | | | | | | | |
|-------------------------------------|-------------------|-----------------------|---------|---------|---------|---------|---------|---------|---------|----------------|---------|----------------|----------------|---------|------|
| | | SyGG | MSyGG | PhRG | CrRG | GuRG | MGuRG | MeGu | Gu | <i>m</i> -Cres | MeSyr | <i>o</i> -Cres | <i>p</i> -Cres | Syr | |
| Cabernet Sauvignon (<i>n</i> = 44) | Median | 1.7 | 0.4 | 0.5 | 1.3 | 0.5 | 0.7 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | 95% CI for median | 1.4–2.1 | 0.4–0.5 | 0.3–0.7 | 1.1–1.5 | 0.5–0.6 | 0.6–1.1 | n.a. | n.a. | n.a. | n.a. | n.a. | n.a. | n.a. | n.a. |
| | IQR | 1.4 | 0.3 | 0.7 | 0.8 | 0.3 | 0.8 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | Maximum | 7.9 | 1.3 | 2.6 | 3.6 | 2.3 | 4.0 | 0.0 | 2.9 | 1.0 | 0.0 | 2.8 | 0.0 | 0.0 | 0.0 |
| | 99th percentile | 7.6 | 1.1 | 2.5 | 3.6 | 2.2 | 3.9 | 1.0 | 2.9 | 1.0 | 2.0 | 2.8 | 1.0 | 2.0 | 2.0 |
| Grenache (<i>n</i> = 44) | Median | 2.4 | 0.4 | 0.6 | 2.2 | 0.7 | 0.6 | 0.2 | 0.6 | 0.1 | 0.3 | 1.0 | 0.1 | 0.3 | |
| | 95% CI for median | 2.0–2.9 | 0.3–0.5 | 0.5–0.8 | 1.7–2.6 | 0.5–0.8 | 0.4–0.7 | 0.2–0.2 | 0.5–0.8 | 0.1–0.1 | 0.2–0.3 | 0.9–1.2 | 0.1–0.1 | 0.3–0.4 | |

Volatile markers:

Results are often very significantly higher than ETS, notably for guaiacol (apparent bias of 2-3 ppb with red grapes)

| | | | | | | | | | | | | | | |
|-----------------------------|-------------------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|
| Sangiovese (<i>n</i> = 34) | Median | 1.0 | 0.5 | 0.5 | 1.2 | 0.4 | 0.7 | 0.5 | 1.0 | 0.1 | 0.1 | 0.6 | 0.1 | 0.2 |
| | 95% CI for median | 0.8–1.3 | 0.2–0.4 | 0.2–0.4 | 1.0–1.4 | 0.3–0.6 | 0.6–0.8 | 0.2–0.3 | 0.8–1.2 | 0.1–0.1 | 0.1–0.1 | 0.6–0.7 | 0.1–0.2 | 0.2–0.3 |
| | IQR | 1.0 | 0.2 | 0.2 | 0.8 | 0.4 | 0.3 | 0.2 | 0.7 | 0.0 | 0.1 | 0.3 | 0.1 | 0.3 |
| | Maximum | 3.0 | 0.5 | 0.7 | 3.8 | 1.6 | 1.1 | 0.7 | 2.8 | 0.2 | 0.4 | 1.6 | 0.5 | 1.0 |
| | 99th percentile | 2.8 | 1.0 | 1.0 | 3.7 | 1.3 | 1.0 | 1.0 | 2.8 | 1.0 | 2.0 | 1.6 | 1.0 | 2.0 |
| Shiraz (<i>n</i> = 67) | Median | 4.6 | 1.2 | 0.3 | 2.2 | 2.4 | 1.3 | 0.0 | 3.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | 95% CI for median | 3.8–5.7 | 1.0–1.4 | 0.2–0.4 | 1.6–2.4 | 2.1–3.1 | 1.1–1.5 | 0.0–0.0 | 2.0–3.0 | 0.0–0.0 | 0.0–0.0 | 0.0–0.9 | 0.0–0.0 | 0.0–0.0 |
| | IQR | 4.1 | 0.9 | 0.4 | 1.6 | 2.0 | 0.9 | 0.0 | 2.0 | 0.0 | 0.0 | 1.6 | 0.0 | 0.0 |
| | Maximum | 14.7 | 4.5 | 2.1 | 5.8 | 9.1 | 4.7 | 0.2 | 9.0 | 0.1 | 0.3 | 5.0 | 0.1 | 0.5 |
| | 99th percentile | 12.3 | 4.5 | 2.0 | 5.2 | 8.8 | 4.7 | 1.0 | 8.0 | 1.0 | 2.0 | 4.3 | 1.0 | 2.0 |

Values in italics indicate that the 99th percentile value has been adjusted up to the limit of quantification of the method; n.a., not applicable. CI, confidence interval; CrRG, cresol rutinoside; Gu, guaiacol; GuRG, guaiacol rutinoside; IQR, interquartile range; *m*-Cres, *m*-cresol; MeGu, 4-methylguaiacol; MeSyr, 4-methylsyringol; MGuRG, methylguaiacol rutinoside; MSyGG, methylsyringol gentiobioside; *o*-Cres, *o*-cresol; *p*-Cres, *p*-cresol; PhRG, phenol rutinoside; SyGG, syringol gentiobioside; Syr, syringol.

Interpretation Guidelines for Free Guaiacol in Berries

Based on our observations so far...

anticipated risk of smoke impact in production wines:*

WARNING: Results may be method dependent (HS-SPME vs. Liquid Extraction)

IMPORTANT: THESE GUIDELINES ARE FOR GUAIACOL, NOT SUM OF COMPOUNDS.
GUIDELINES ARE SIMPLY OBSERVATIONS BASED UPON PAST EVENTS,
AND MAY OR MAY NOT APPLY TO CURRENT OR FUTURE EVENTS.
ETS DOES NOT, AND WILL NOT, PROPOSE ACCEPTANCE OR REJECTION CRITERIA.

Free Guaiacol ($\mu\text{g}/\text{kg}$)

*(*except Syrah)*

Interpretation Guidelines for Free Guaiacol in Berries

Based on our observations so far...

anticipated risk of smoke impact in production wines:*

WARNING: When interpreting lab results, do NOT use interpretation guidelines from a different source!

IMPORTANT: THESE GUIDELINES ARE FOR GUAIACOL, NOT SUM OF COMPOUNDS.
GUIDELINES ARE SIMPLY OBSERVATIONS BASED UPON PAST EVENTS,
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Free Guaiacol ($\mu\text{g}/\text{kg}$)

*(*except Syrah)*

Thank you for your attention



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