



GLUTATHIONE

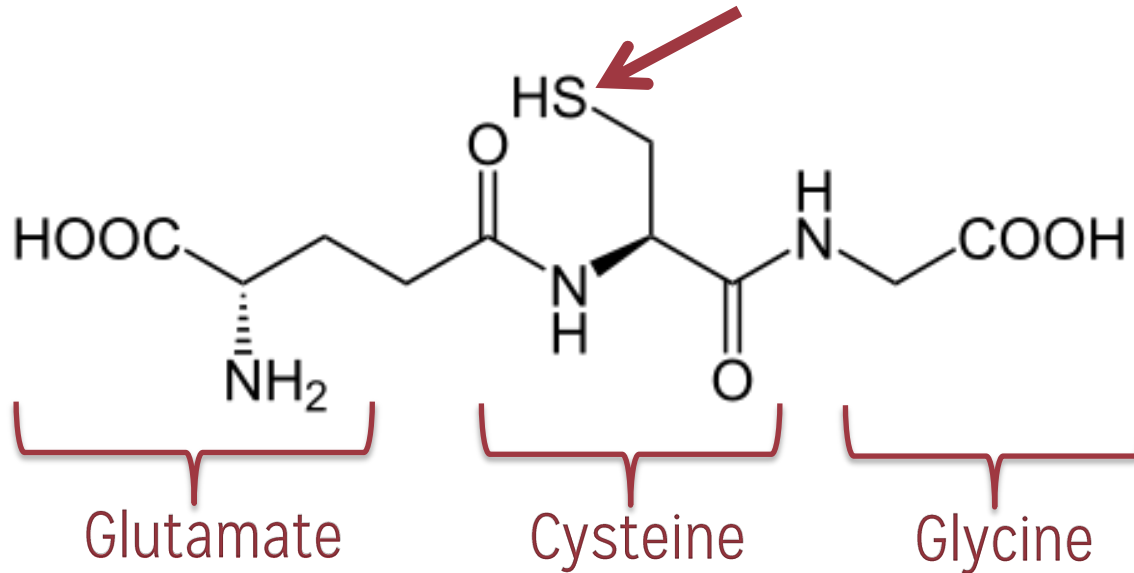
A POWERFUL NATURAL PROTECTOR
OF WHITE WINE AROMA & FLAVOR

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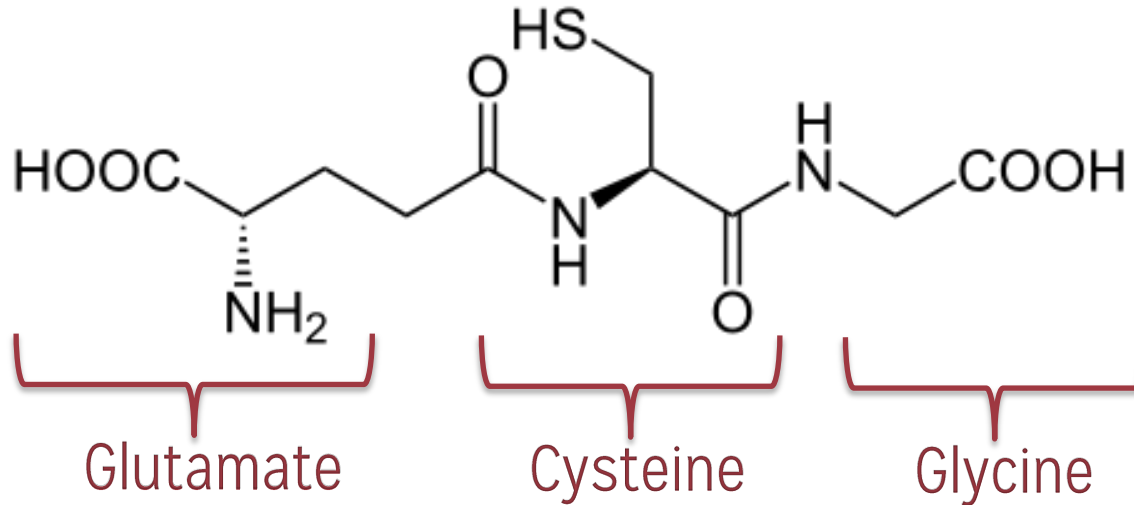
KNOWING GLUTATHIONE

GLUTATHIONE



- ⚙️ A natural tripeptide
- ⚙️ Antioxidant properties (thiol group)
- ⚙️ Prevents oxidative damage from free radicals & peroxydes in live cells

GLUTATHIONE



- Present in grapes, juices, and wines
- Renewed interest in wine research
- Commercial fermentation aids marketed as boosting glutathione levels in wine (direct addition not approved)

Why?

In response to current
winemaking issues and
challenges...



DEMAND FOR FRESH AND VARIETAL WHITE WINES, ROSES



Main aroma compounds involved (terpenes & thiols) are easily oxidizable







Contact with oxygen can quickly cause loss of aroma and flavor



Short shelf life

Glutathione protects fragile aromas from oxidation

“UNTYPICAL AGING” OF WHITE WINES

-  First described in German white wines
-  Main culprit: 2-aminoacetophenone (2AA)
-  Not restricted to Riesling: a symptom of white wine “premature aging”
-  Linked to hydric stress in vineyards

Glutathione inhibits the formation of 2AA



PREMATURE OXIDATION ("PREMOX") OF WHITE WINES



Mainly with barrel-aged chardonnays



Faster loss of fruit and appearance of oxidation symptoms in bottle



Faster formation of oxidative aroma compounds (sotolon...)

Linked to glutathione-depleted grapes from vineyards with low available nitrogen

PRESSURE TO DECREASE THE USE OF SO₂



Consumers



Health authorities



Organic/biodynamic certification
groups




Can the main natural antioxidant in grapes help?



PRESERVING GLUTATHIONE

FROM WHERE?

SOURCES OF GLUTATHIONE

-  Present in grapes and juice
-  Absorbed by yeast early in fermentation, but released in later phases
-  Additional release into wine during on-lees aging

INFLUENCES

ON GLUTATHIONE LEVELS

Concentration in wine depends on levels in grapes and must *(Dubourdieu and Lavigne, 2003)*






Levels in grapes depend on:

- ⊕ Soil available nitrogen (positive)
- ⊕ Copper (negative)
- ⊕ Maturity level (variable)

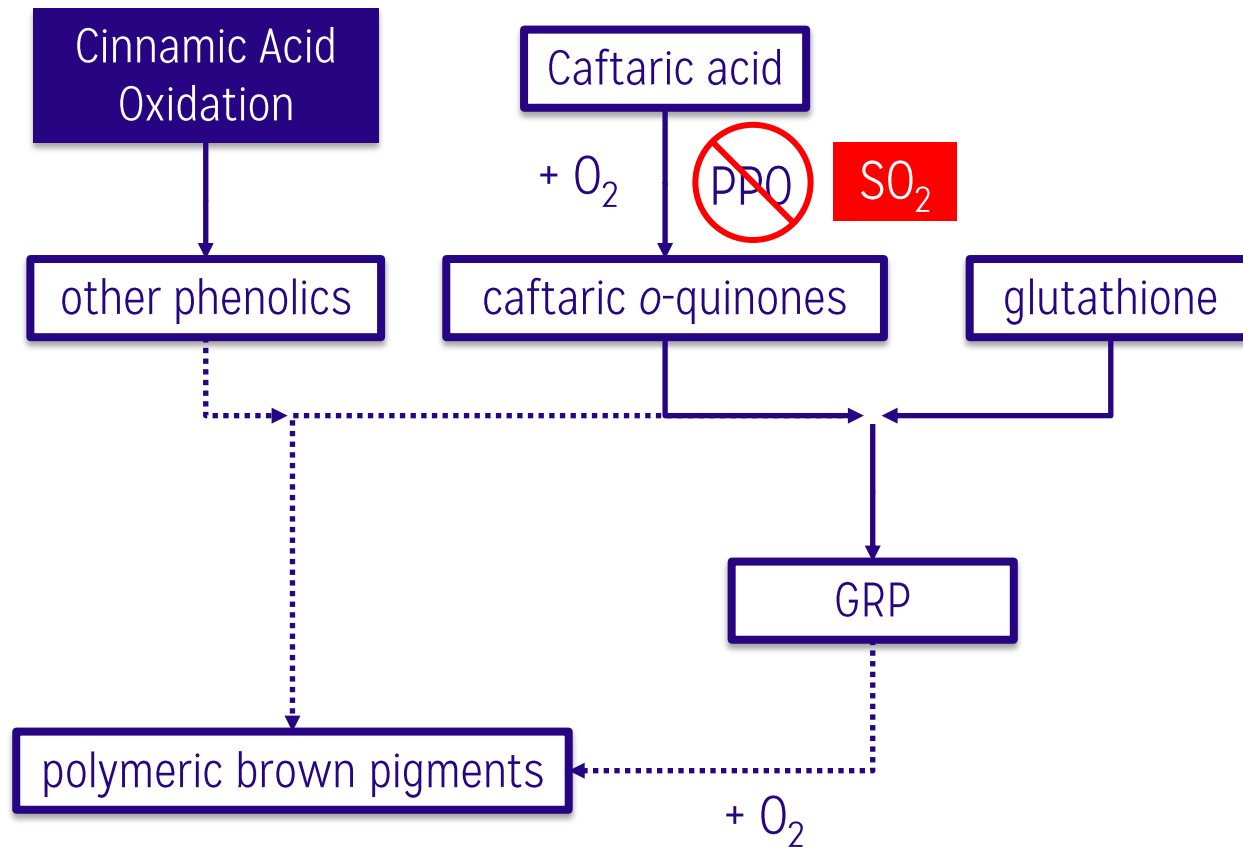
PRESERVING GLUTATHIONE

LOSSES IN GRAPES AND JUICE

-  **Grape handling:** harvesting, destemming, cold soak, pressing
-  **Juice oxidation:** minimized by dry ice, inert gas in press tanks, SO₂
-  **Phenolics** from press juices

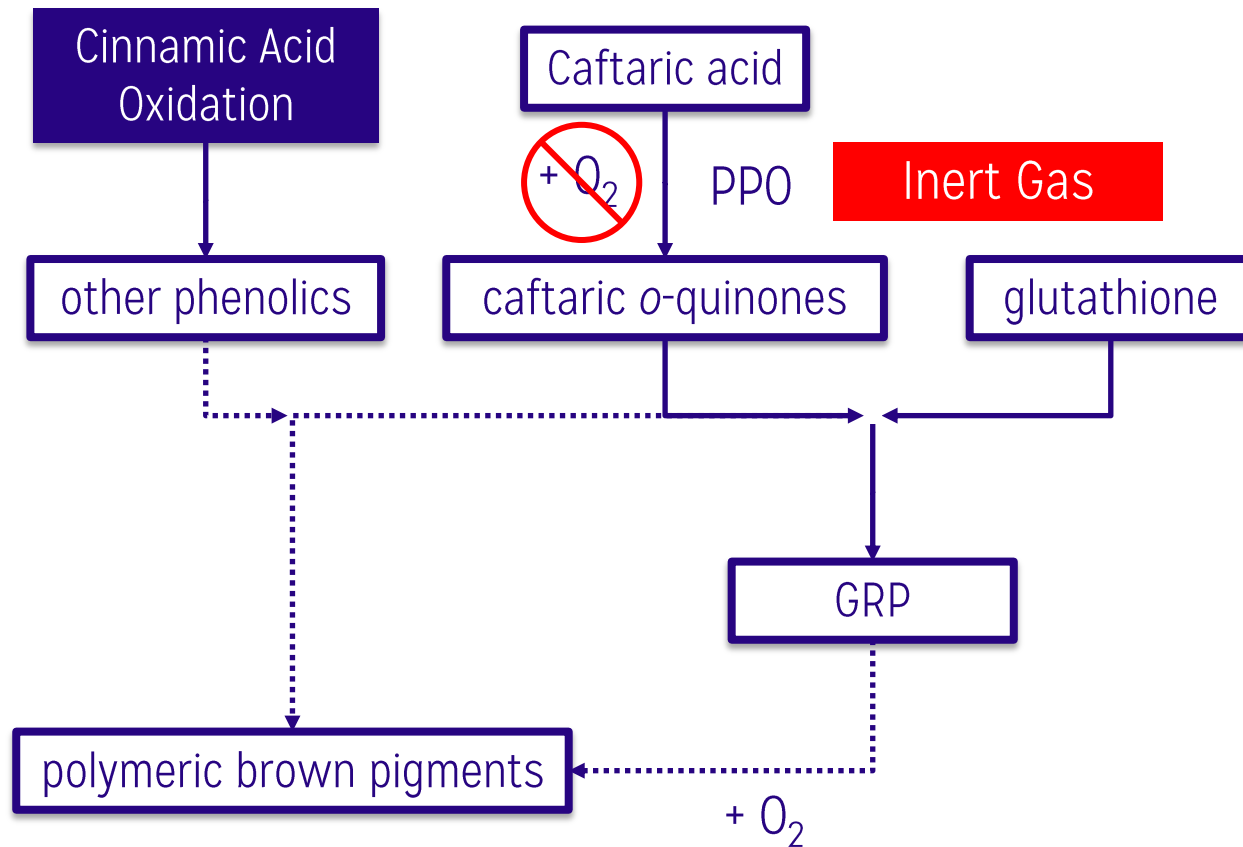
INTERACTIONS

QUICKLY REACTS WITH QUINONES



INTERACTIONS

QUICKLY REACTS WITH QUINONES



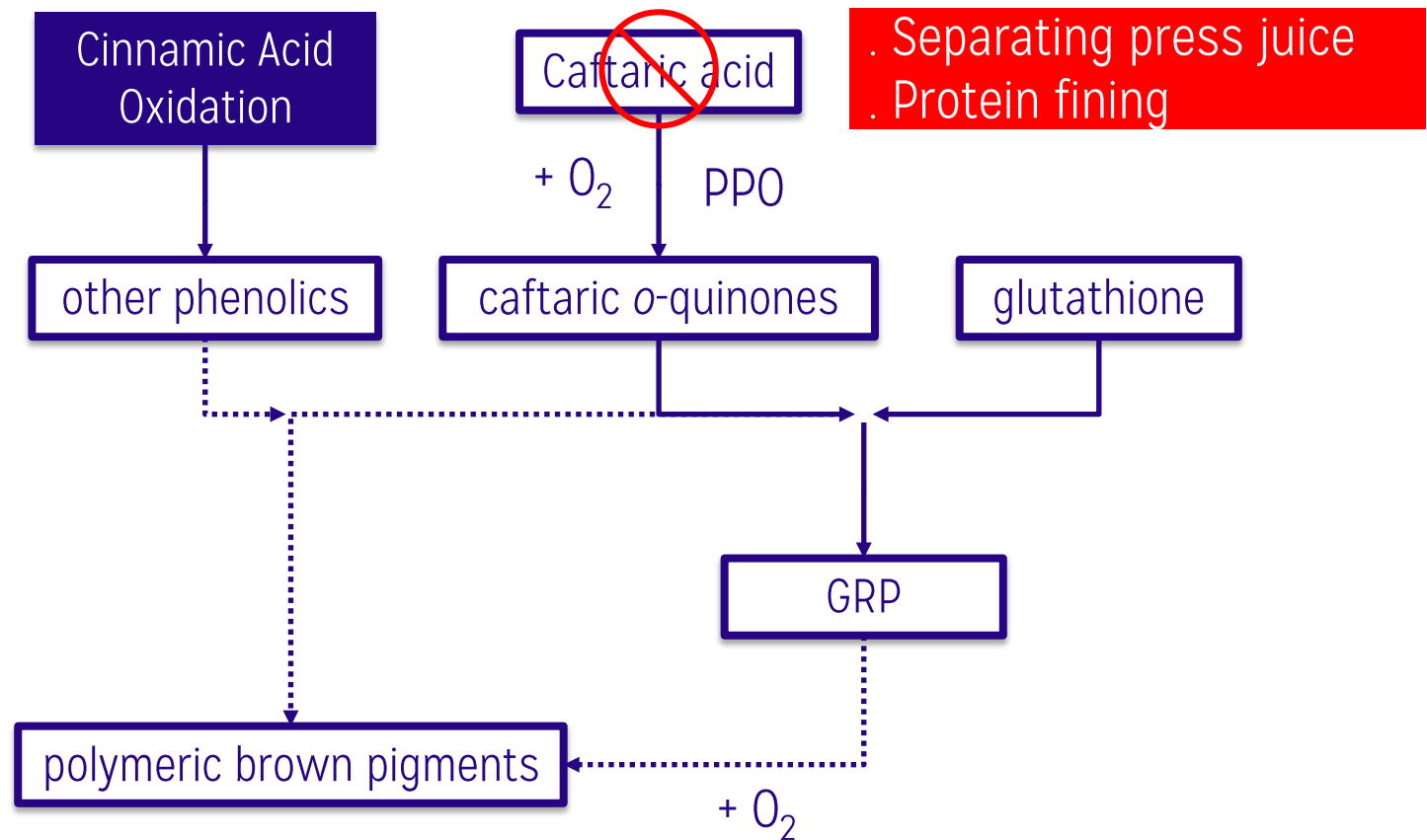
ANAEROBIC PRESSING



New presses feature inert gas recycling

INTERACTIONS

QUICKLY REACTS WITH QUINONES

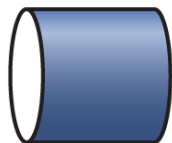


ANALYZING GSH

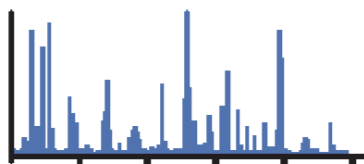
UHPLC & QQQ MASS SPECTROMETRY (MS/MS)



Analytes are ionized in the inert ion source after chromatographic separation by the GC.

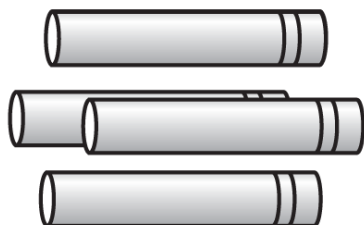


Inert Ion Source

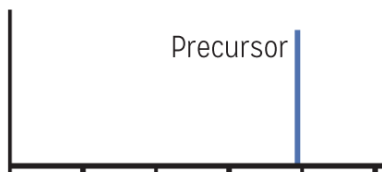


Target and matrix ions created from ionization

The target precursor ion is isolated from the matrix in the first quartz quadrupole mass analyzer.

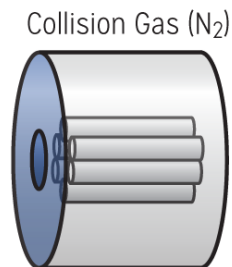


Quartz Quadrupole



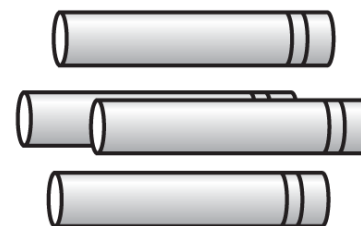
Target precursor ion isolated from non-target ions

Collisional processes in the hexapole collision cell dissociate the precursor ion into unique product ions.

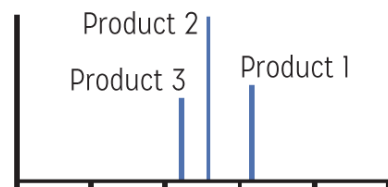


Hexapole Collision Cell

Unique product ions transmitted rapidly and efficiently avoiding ion ghosting and cross-talk.

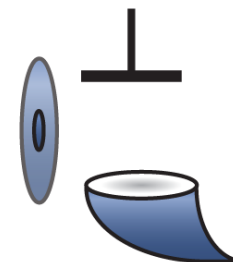


Quartz Quadrupole



Product ions measured against reduced chemical noise

Ions exit the second quadrupole and are guided through a triple-axis detector to a high-energy dynode.



Triple-Axis Detector

The unique ion path in the triple-axis detector significantly reduces neutral noise from secondary ions resulting in femtogram level detection of target analytes.

SAMPLING CHALLENGES

SPECIAL PROCEDURES TO ENSURE
ACCURATE RESULTS



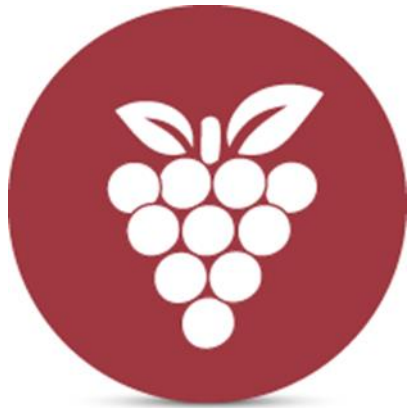
Grapes: undamaged berries on ice packs



Unfinished Wines: sampling tubes with
added antioxidant

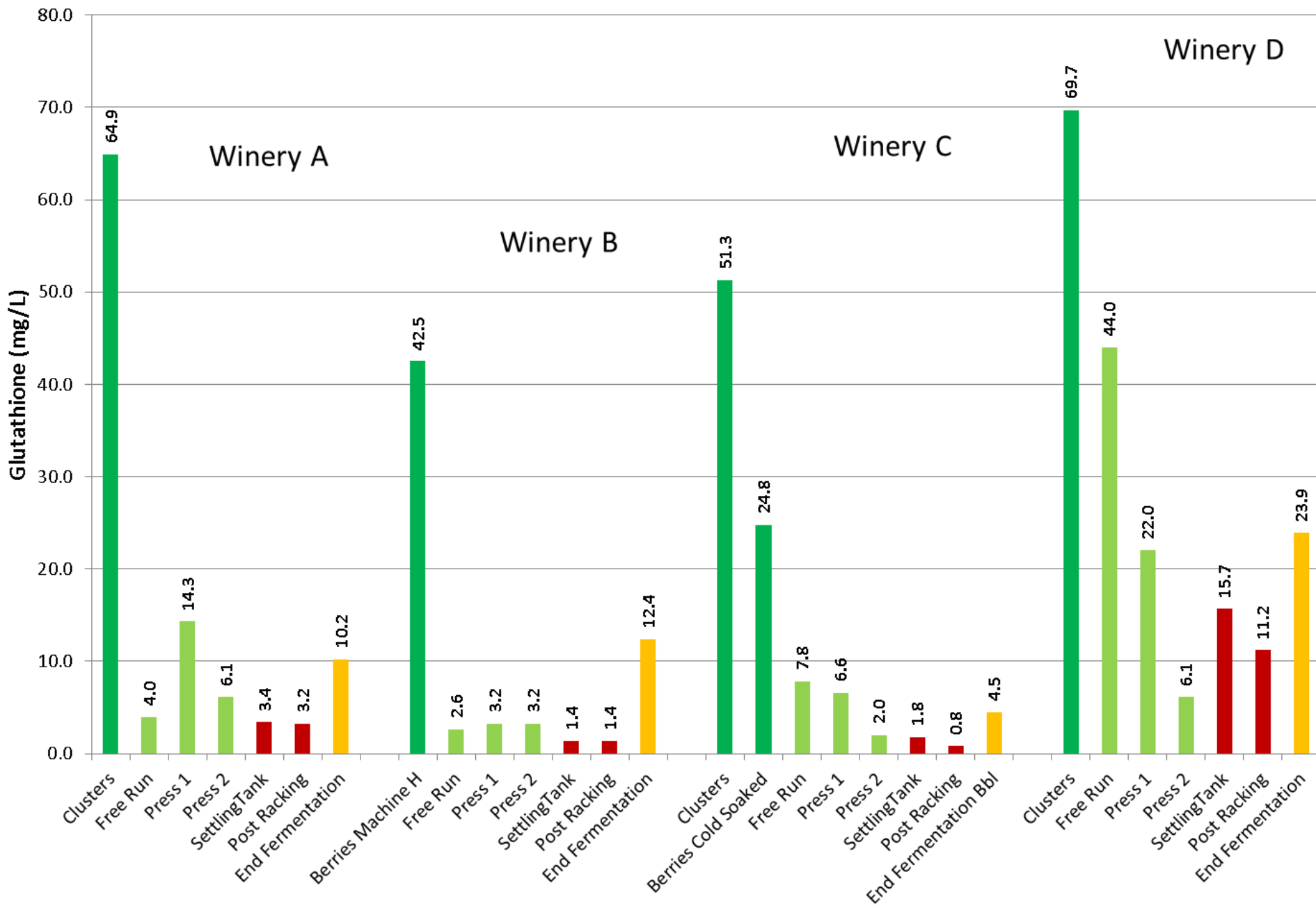


Commercial wines: unopened commercial
bottles



EXAMPLES OF MONITORING DURING WHITE WINEMAKING

HARVEST 2013 TRIALS - SAUVIGNON BLANC

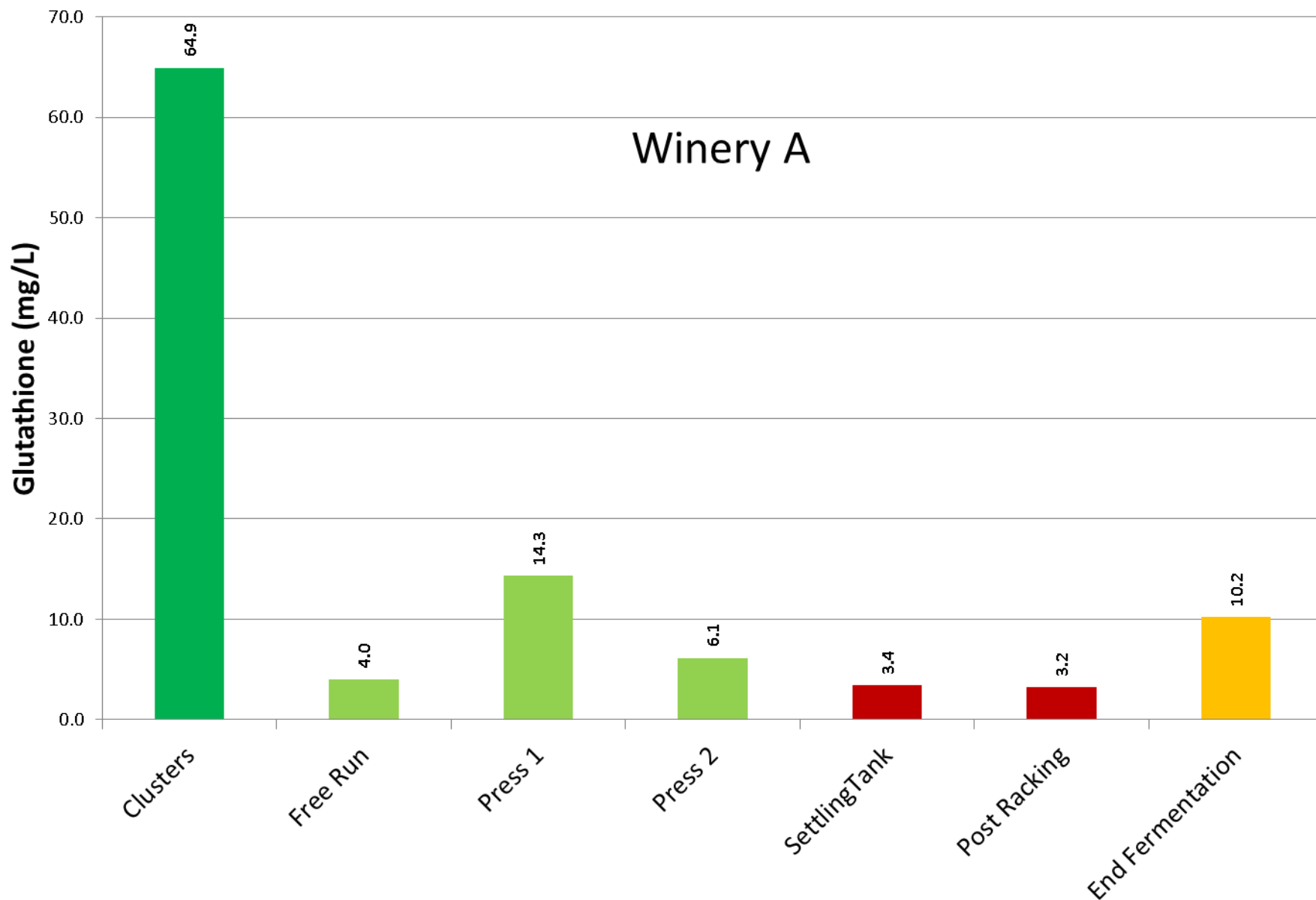


WINERY A

HAND HARVESTED FRUIT IN ½ - TON BINS
100% WHOLE CLUSTER PRESSING
DRY ICE IN PRESS PAN

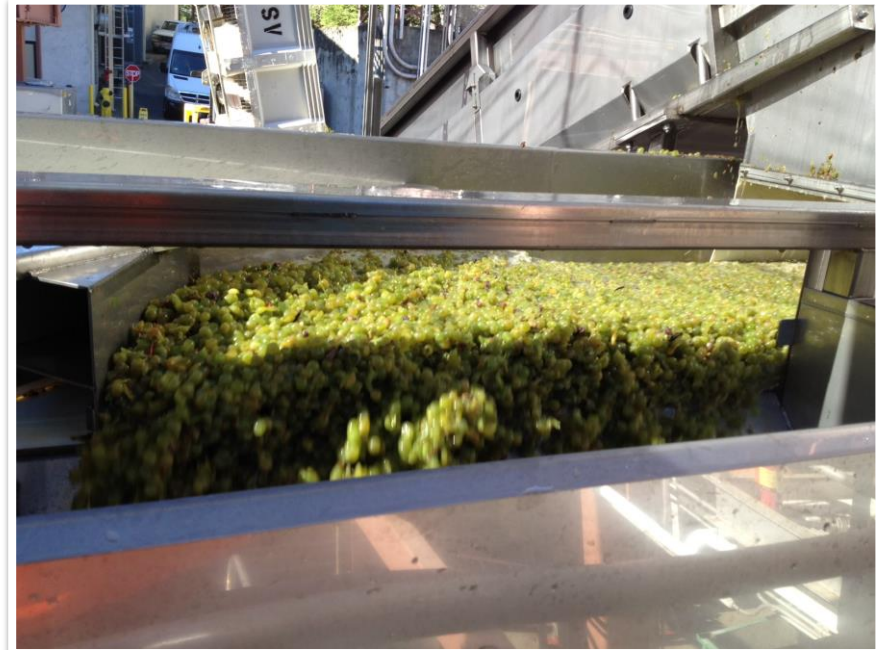


Harvest 2013 Trials - Sauvignon Blanc

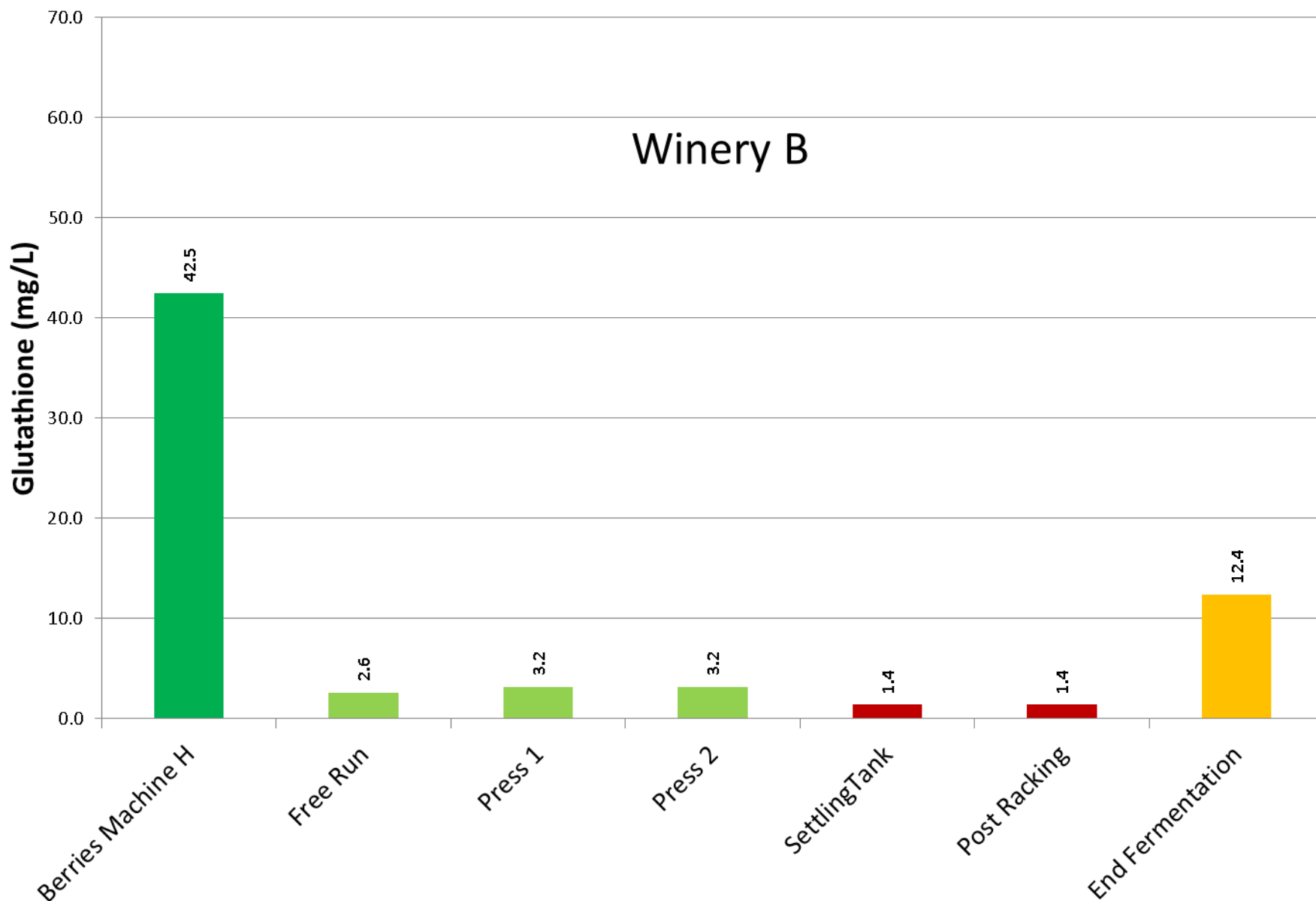


WINERY B

MACHINE-HARVESTED FRUIT IN ½-TON BINS
PRESS LOADED BY CONVEYER BELT
DRY ICE IN PRESS PAN



Harvest 2013 Trials - Sauvignon Blanc

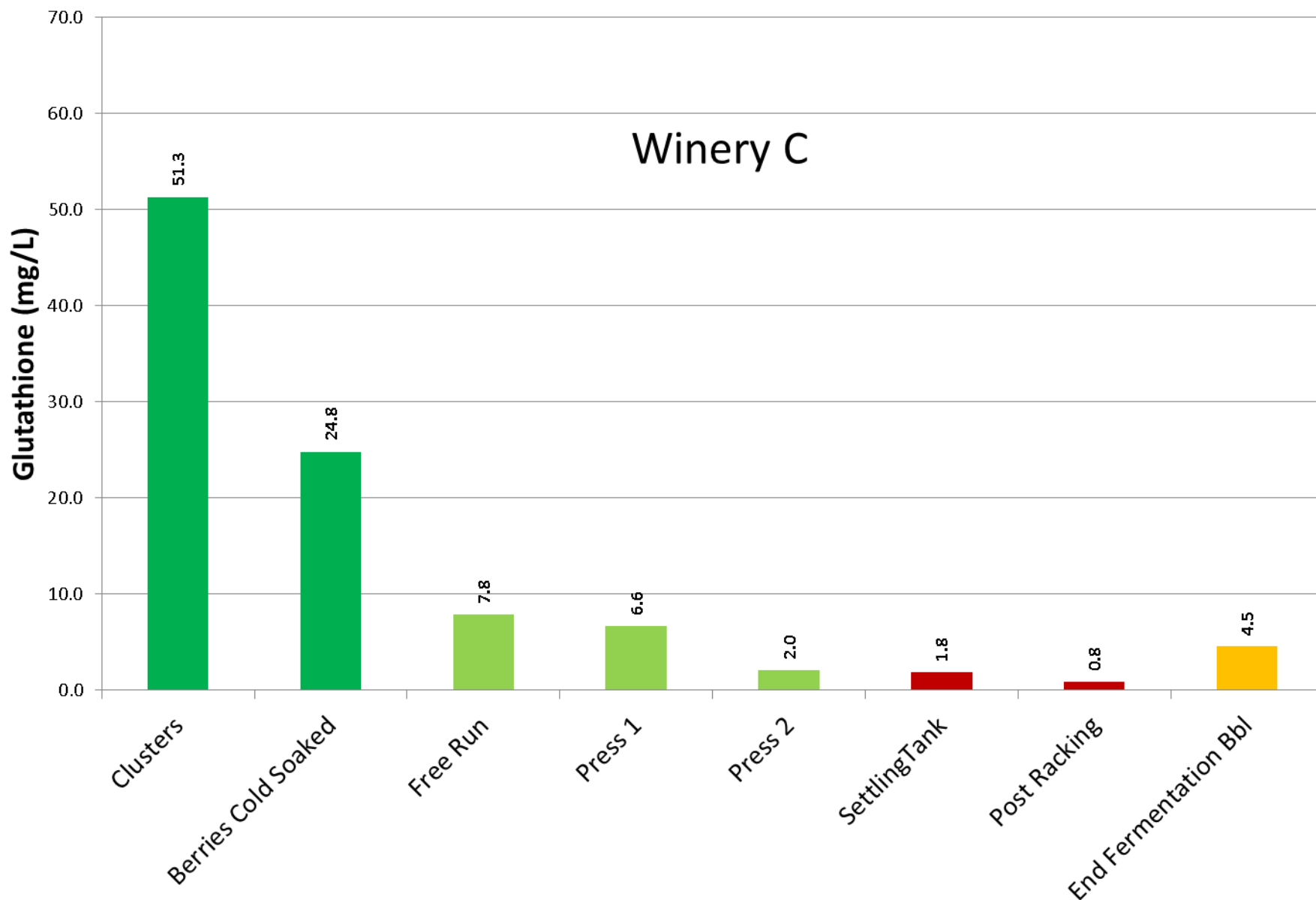


WINERY C

HAND HARVESTED, DESTEMMED FRUIT COLD-SOAKED IN ½ - TON BINS
LIQUID CO₂ AND DRY ICE IN COVERED PRESS PAN
BARREL FERMENTATION



Harvest 2013 Trials - Sauvignon Blanc



WINERY D

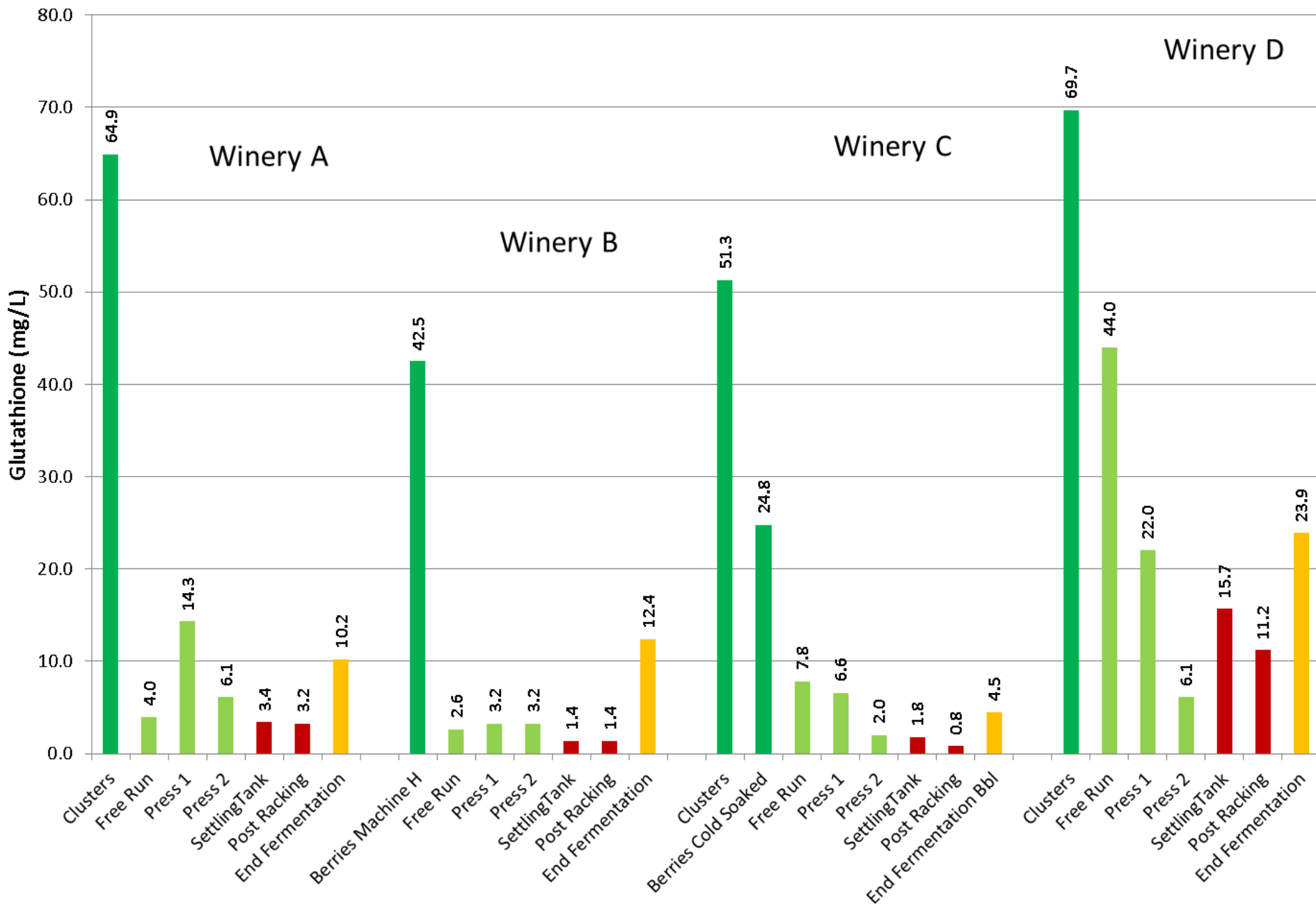
HAND HARVESTED FRUIT IN 25 LB. LUGS
30% DESTEMMED, 70% WHOLE CLUSTERS
DRY ICE IN DIY COVERED PRESS



Harvest 2013 Trials - Sauvignon Blanc



HARVEST 2013 TRIALS - SAUVIGNON BLANC



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