



# GLUTATHIONE

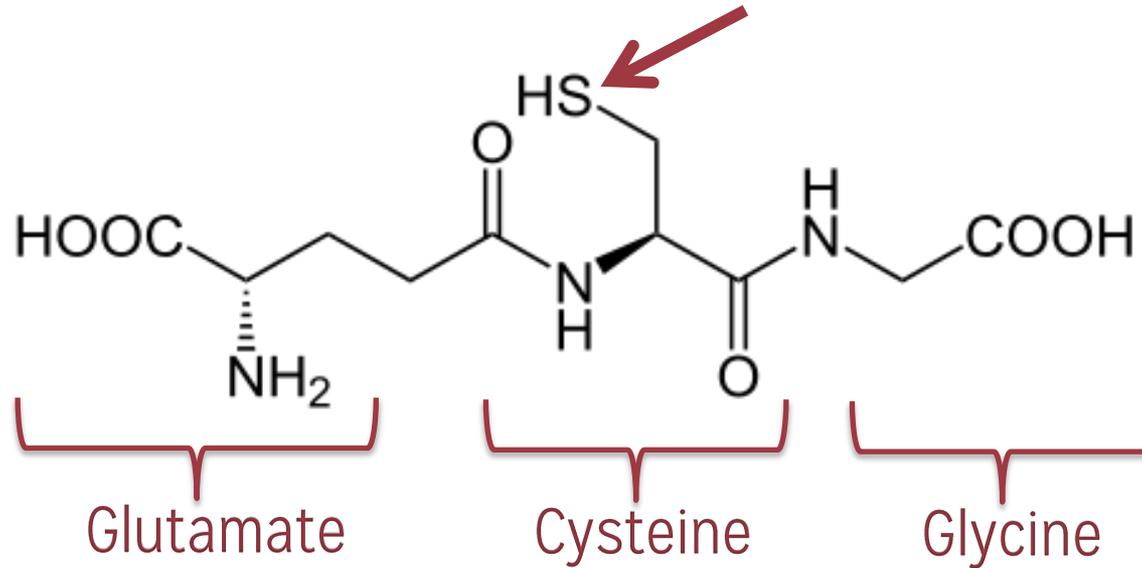
A POWERFUL NATURAL PROTECTOR  
OF WHITE WINE AROMA & FLAVOR

**Eric Hervé Ph.D**  
**ETS Laboratories**



# KNOWING GLUTATHIONE

# GLUTATHIONE



A natural tripeptide

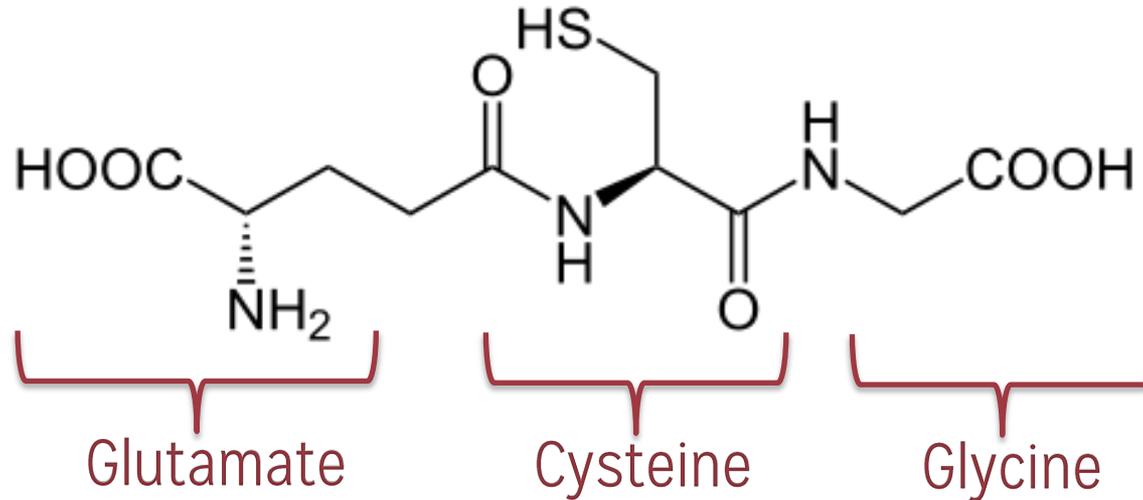


Antioxidant properties (thiol group)



Prevents oxidative damage from free radicals & peroxydes in live cells

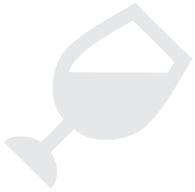
# GLUTATHIONE



- 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***

# “UNUSUAL 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 SO<sub>2</sub>



Consumers



Health authorities



Organic/biodynamic certification  
groups

***Can the main natural antioxidant in grapes help?***



# PRESERVING GLUTATHIONE

# FROM WHERE?

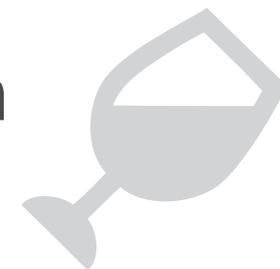
## SOURCES OF GLUTATHIONE

-  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)

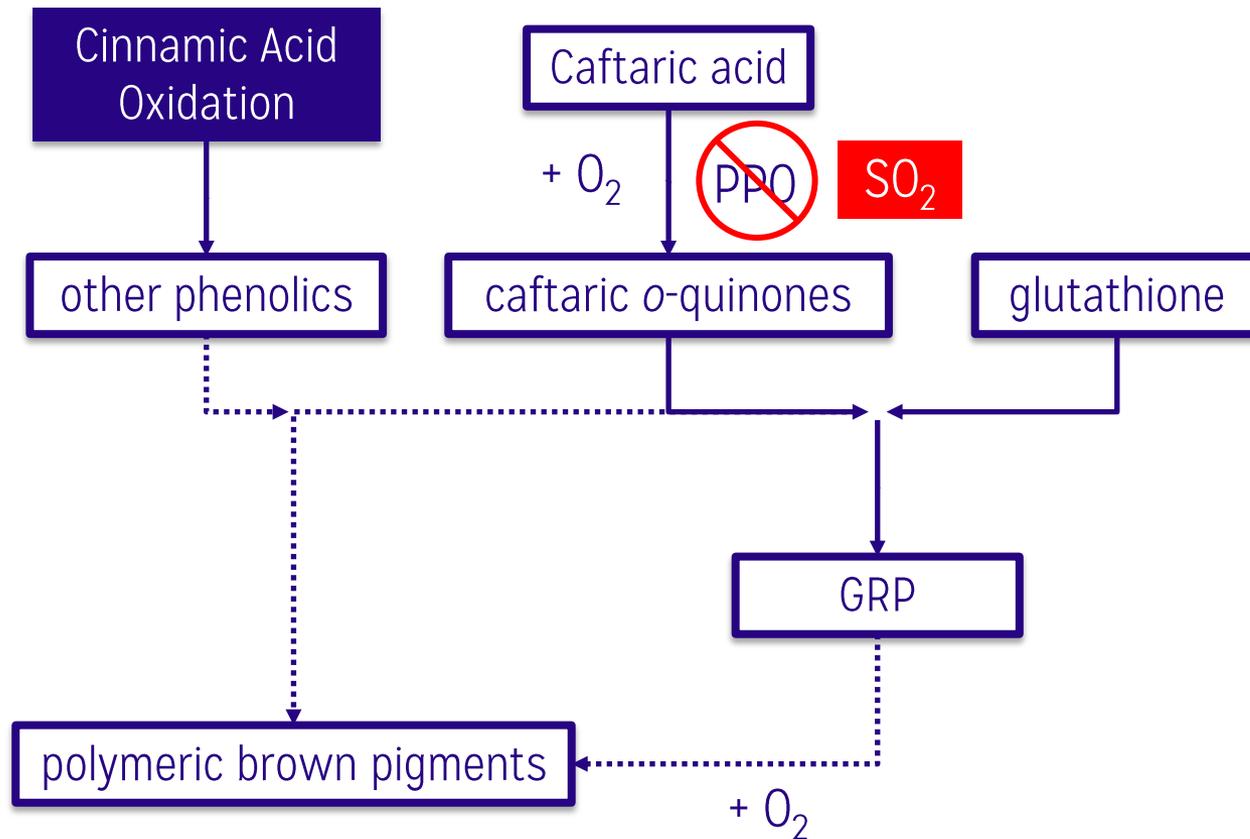
# PRESERVING GLUTATHIONE

## LOSSES IN GRAPES AND JUICE

-  **Grape handling:** harvesting, destemming, cold soak, pressing
-  **Juice oxidation:** minimized by dry ice, inert gas in press tanks, SO<sub>2</sub>
-  **Phenolics** from press juices

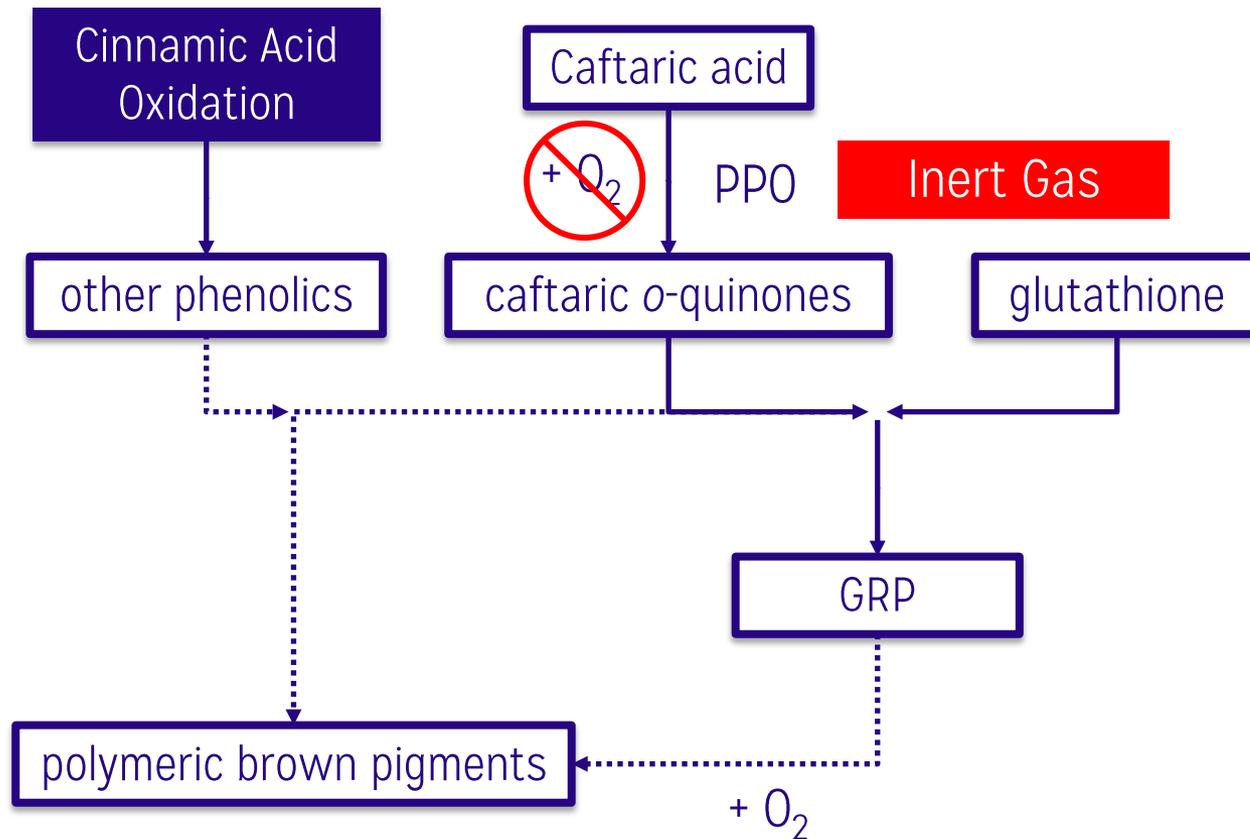
# INTERACTIONS

QUICKLY REACTS WITH QUINONES



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# ANAEROBIC PRESSING



New presses feature inert gas recycling

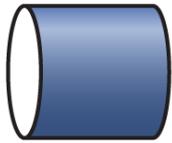


# ANALYZING GSH

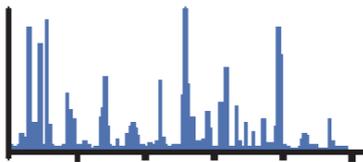
## UHPLC & QQQ MASS SPECTROMETRY (MS/MS)



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

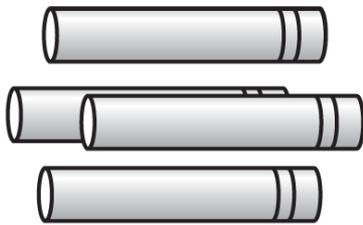


Inert Ion Source

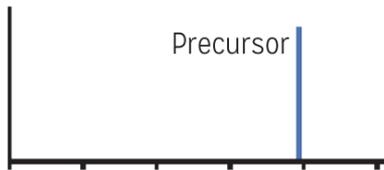


Target and matrix ions created from ionization

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

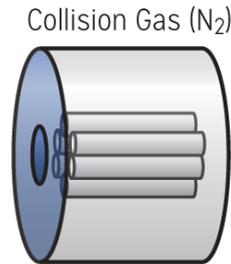


Quartz Quadrupole



Target precursor ion isolated from non-target ions

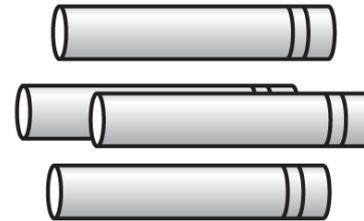
Collisional processes in the hexapole collision cell dissociate the precursor ion into unique product ions.



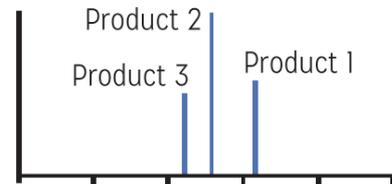
Hexapole Collision Cell

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

Product ions are further separated from interferences in the second quartz quadrupole mass analyzer.

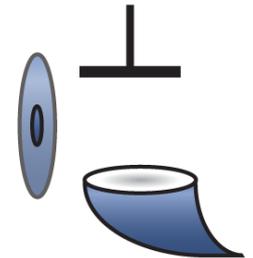


Quartz Quadrupole



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



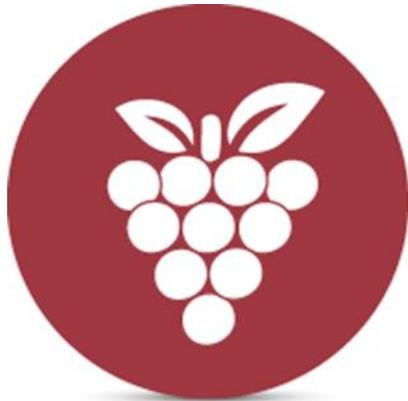
**Grapes:** undamaged berries on ice packs



**Unfinished Wines:** sampling tubes with added antioxidant

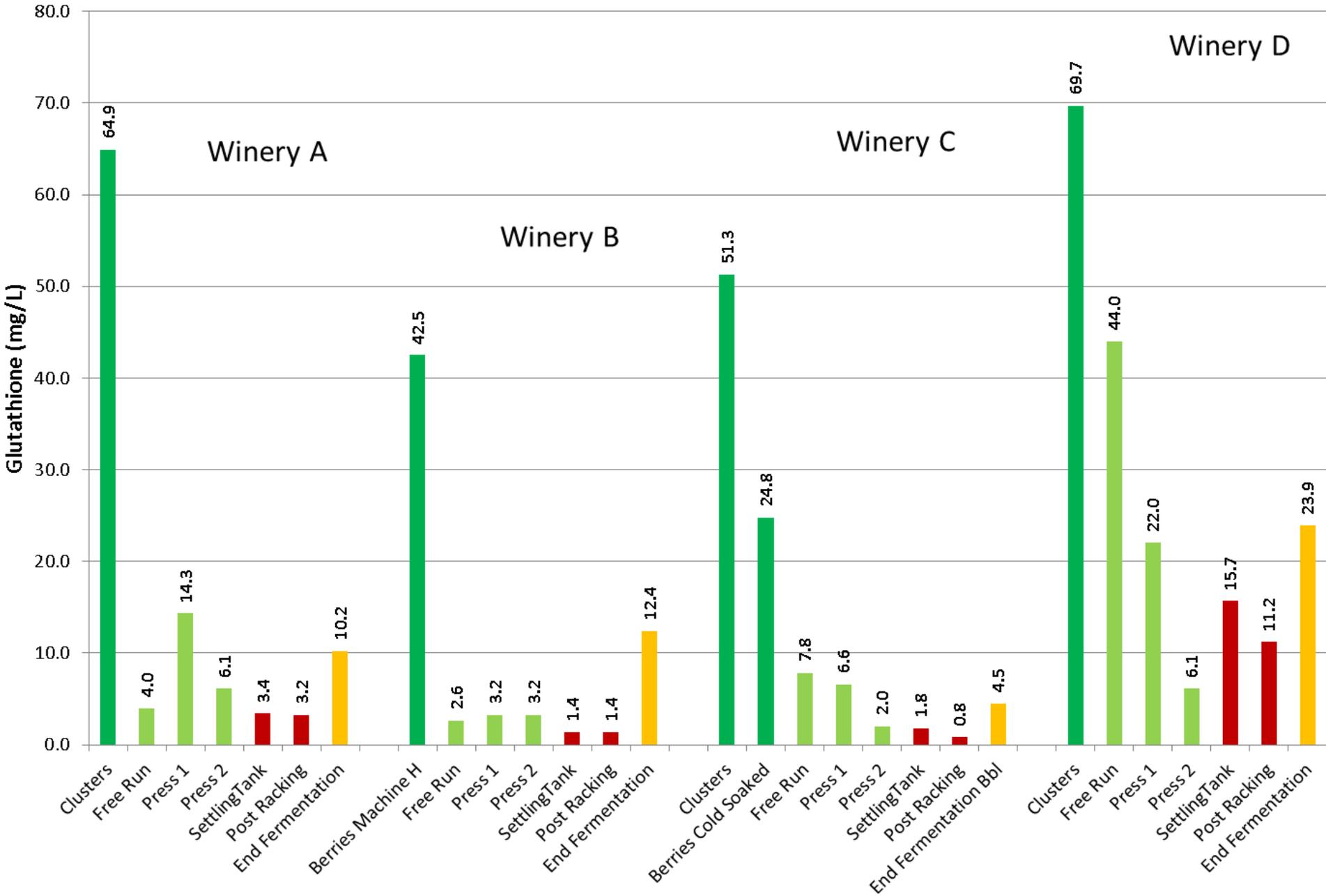


**Commercial wines:** unopened commercial bottles



# EXAMPLES OF MONITORING DURING WHITE WINEMAKING

# HARVEST 2013 TRIALS - SAUVIGNON BLANC



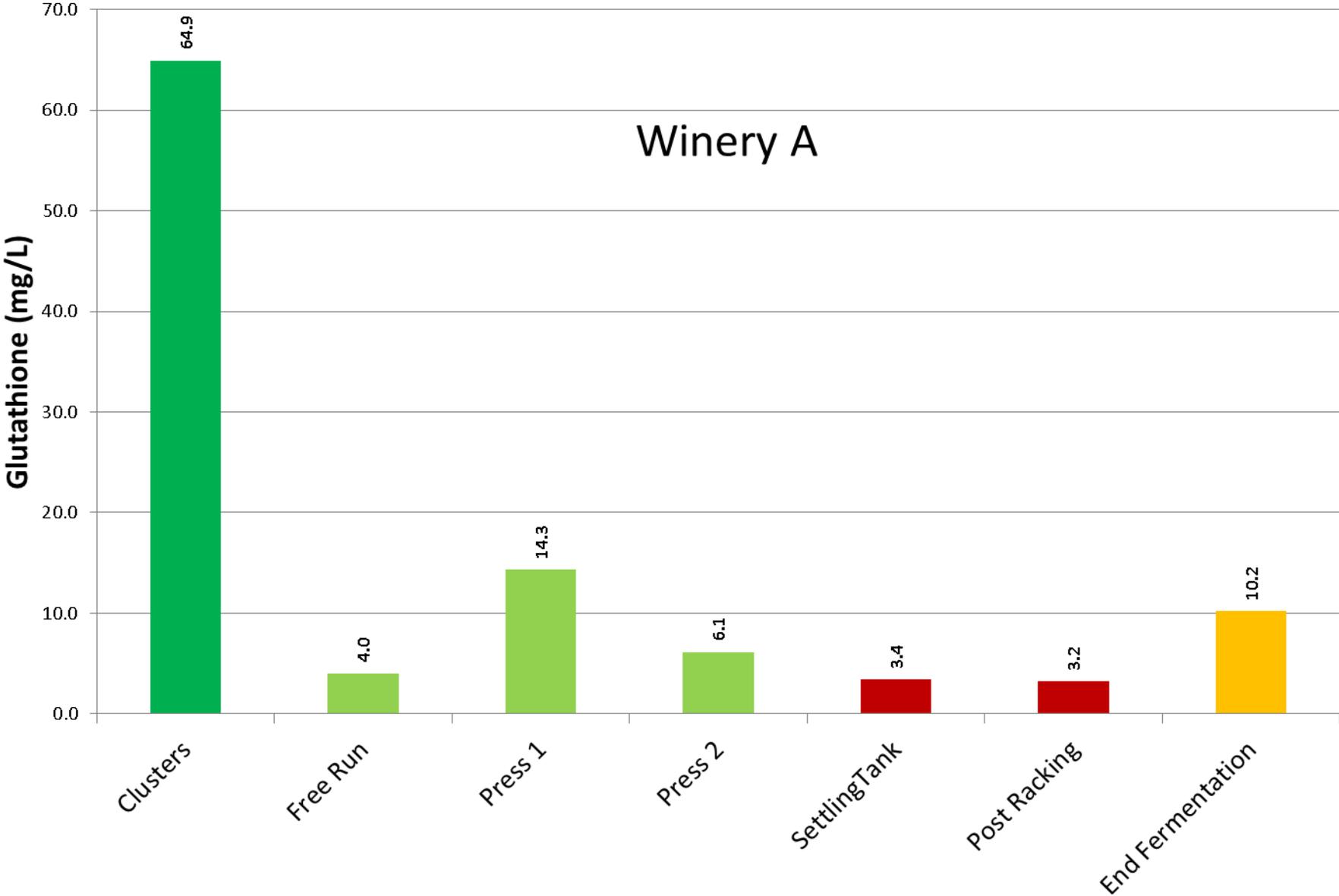
# WINERY A

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



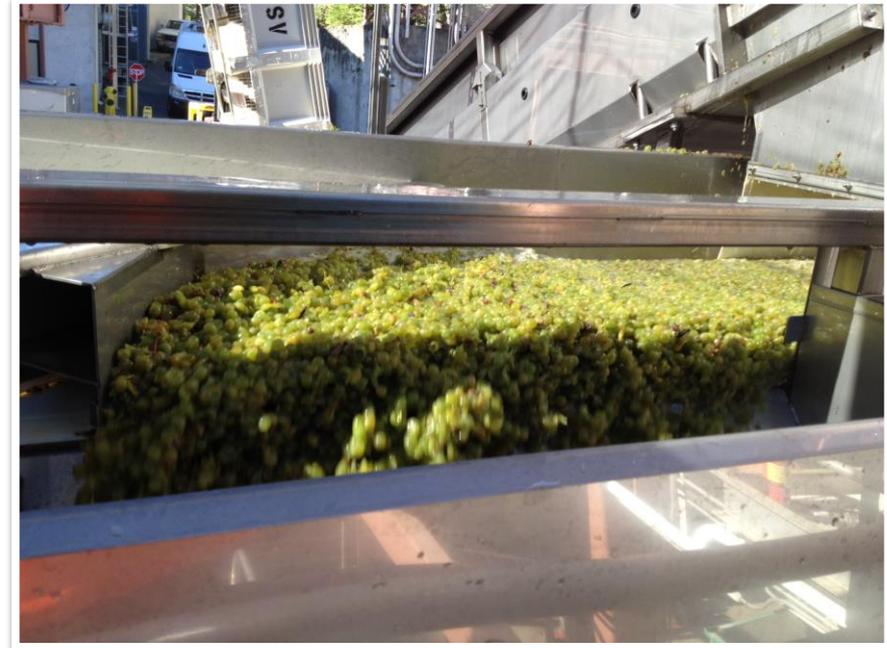
# Harvest 2013 Trials - Sauvignon Blanc

Winery A

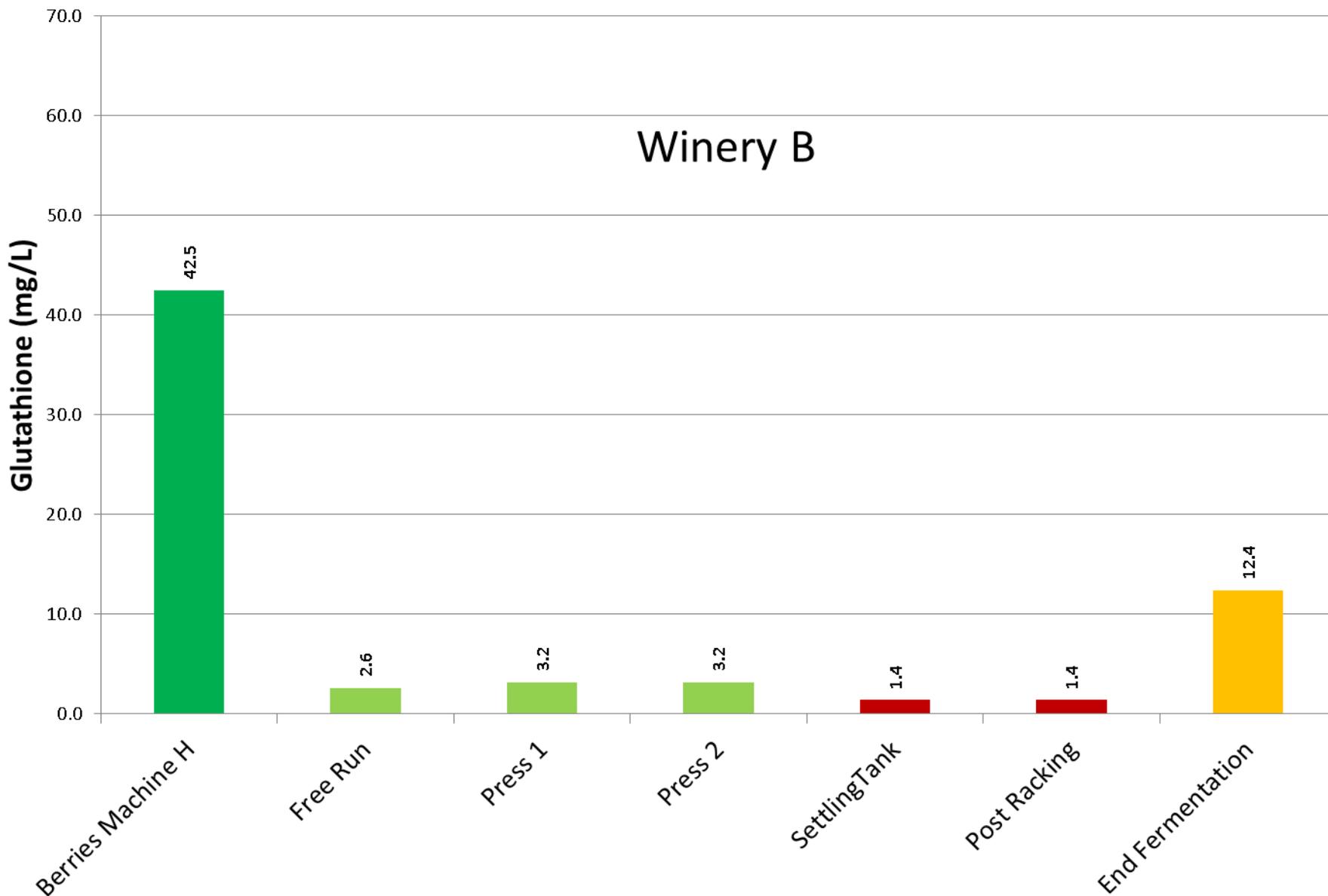


# WINERY B

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



# Harvest 2013 Trials - Sauvignon Blanc

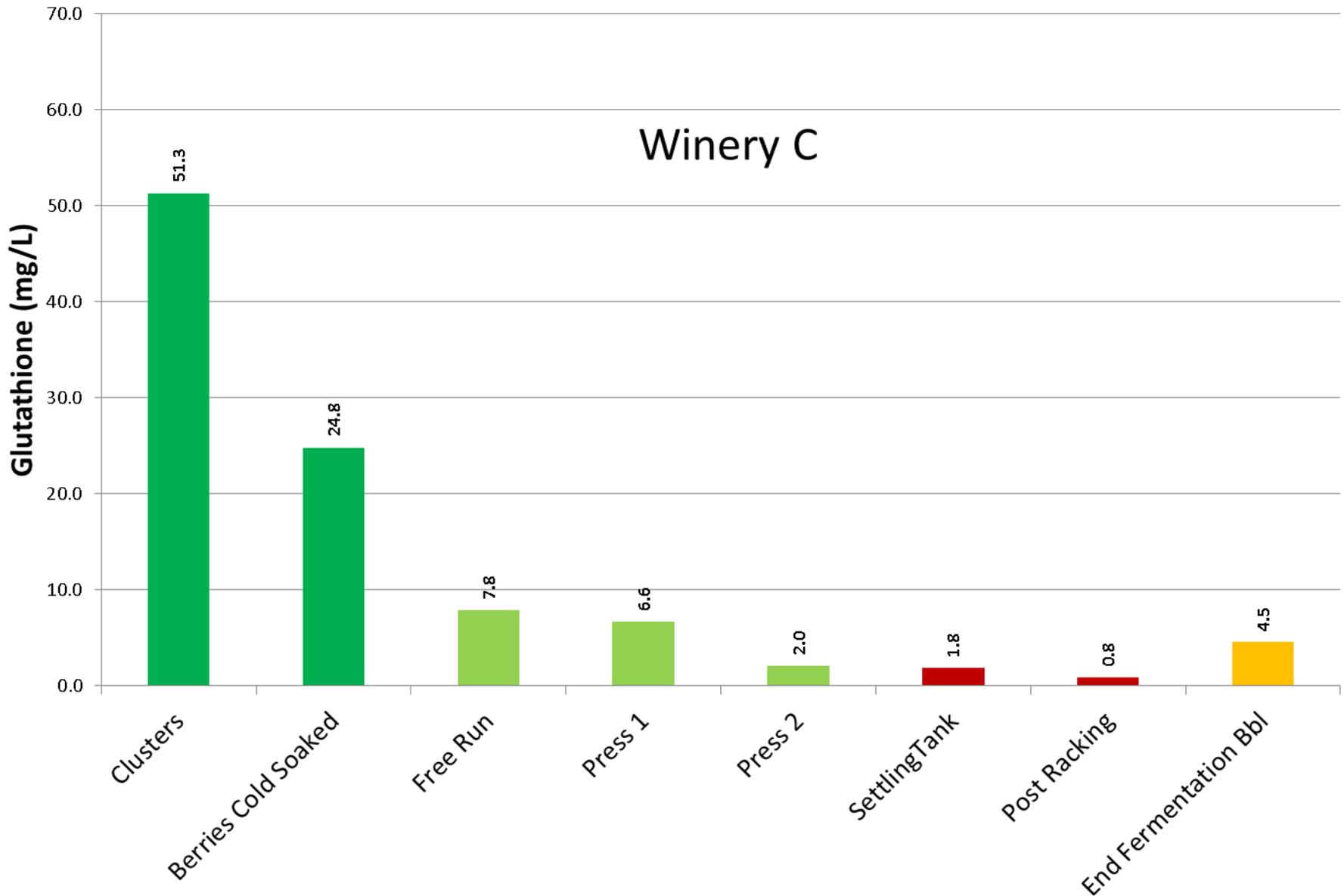


# WINERY C

HAND HARVESTED, DESTEMMED FRUIT COLD-SOAKED IN ½ - TON BINS  
LIQUID CO<sub>2</sub> AND DRY ICE IN COVERED PRESS PAN  
BARREL FERMENTATION



# Harvest 2013 Trials - Sauvignon Blanc



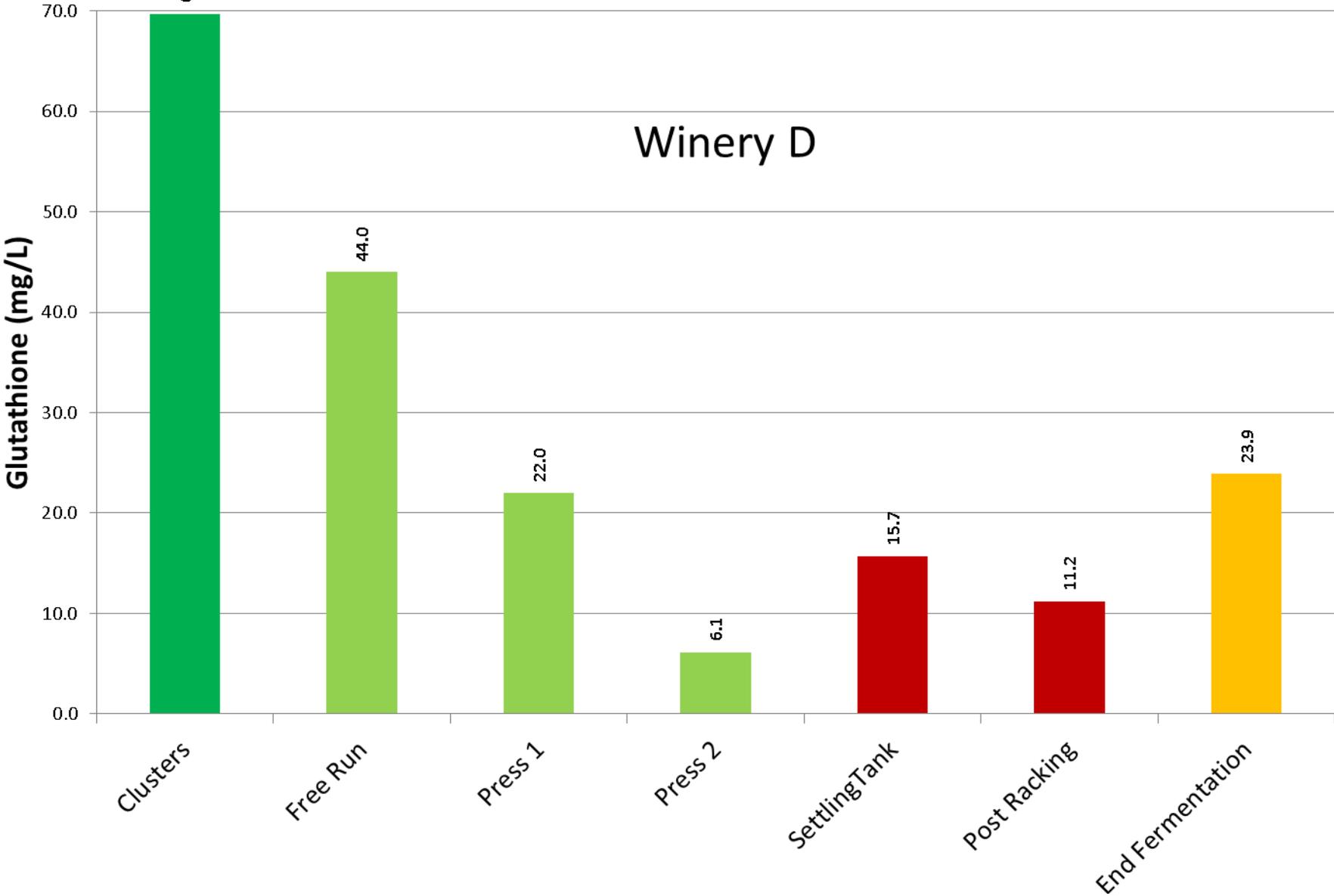
# WINERY D

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

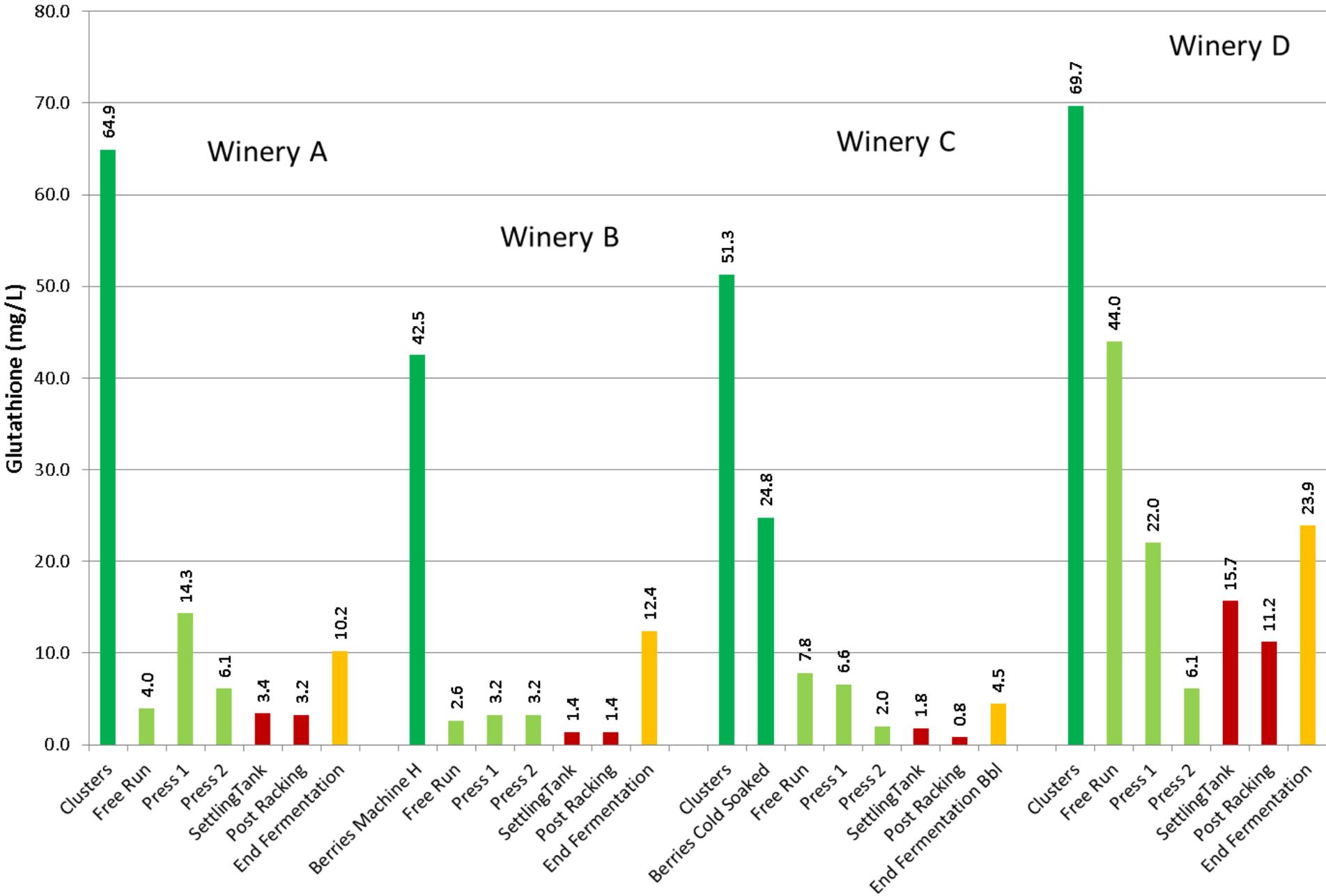


# Harvest 2013 Trials - Sauvignon Blanc

Winery D



# HARVEST 2013 TRIALS - SAUVIGNON BLANC



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