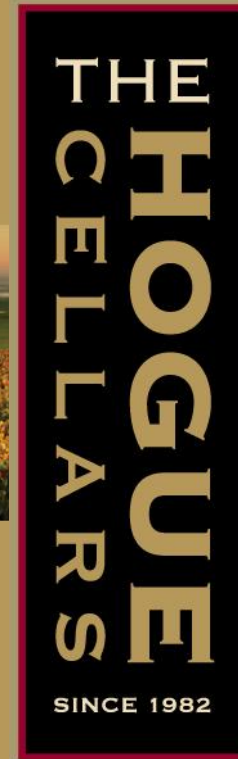


Unscrew The Facts



Closure Study 2005-2010

Impact of Bottle Closures on Shelf Life
of Wine

*Results shared 06/23/11

Proprietary Information: Do not forward, copy or distribute to unauthorized parties.

© 2011 The Hogue Cellars, LTD, Prosser, WA.

Our First Closure Study

Our 1st closure study took place over three years from 2001-2004 using a Merlot and a Chardonnay. The study compared cork, synthetic and screwcap, and found that in general, wines bottled and aged under saranex screwcaps were clean, held their fruit and showed the least reductive character.

It was a broad study, but as a result The Hogue Cellars moved 70 percent of its production to screwcap in 2004.

Why another study?

Hogue Cellars Closure Study 2005-2010



- Validate 2004 study results
 - Previous research has shown that different bottle closures can impact the quality of bottled wines over time (shelf life), and that oxygen plays a significant role in this.
 - Several questions remain about the interaction of the wine matrix, the closure, and bottling conditions.
- Evaluate oxygen ingress impact on wines, fruit preservation, ability to age.
- Address concerns about consumer attitudes towards screwcap closures.

Overall Goals

2005-2010 Study



- Better understand the results unveiled in 2004, by further researching the impact on an oxygen-sensitive wine
 - We studied and tested Sauvignon (Fumé) Blanc every four months over a three year timeframe
- Understand the effects of screwcap closures on the long-term aging of red wines
 - Two Merlots made with different vinification methods: compare early-to-bottle versus aged wines
 - Studied over five years

Sensory Evaluation – Expert Panel



- Professionally trained tasting panel of seven people
 - Hogue Winemakers based onsite at winery
- Evaluations done using consistent **QUALITY** parameter
- Computer-based system
 - Compare, discuss, and review all data

Part One – Oxygen Sensitive Wine

SAUVIGNON (FUMÉ) BLANC



Oxygen Sensitive Wine Fumé Blanc Study

HOGUE



- The study, begun in 2005, was conducted with a 2004 Fumé Blanc, bottled in May 2005.
 - Wine chosen because it is the most oxygen sensitive wine
 - All wines bottled on the Hogue commercial bottling line at steady-state rate of oxygen exposure.

Oxygen Sensitive Wine Fumé Blanc Study

10 Different Closures – NO CORK!

Closures used in Sauvignon Blanc Trial			
Class	Closure	Cluster	Treatment
Screwcap	Scap MfrA - Aluminum	1	Producer A, experimental liner - aluminum for very low O2 ingress
	Scap MfrA - Saranex	2	Producer A, polymer low-ingress (Saran) liner product
	Scap MfrA - poly Med O2	3	Producer A, experimental liner - Polyester foam for increased O2 ingress
	Scap MfrA - poly High O2	4	Producer A, experimental liner - Polyethylene foam for higher O2 ingress
	Scap MfrA - Scavenger	2	Producer A, experimental liner - polymer impregnated with O2 scavenger
	Scap MfrB - Tin	1	Producer B, commercial tin liner for very low O2 ingress
	Scap MfrB - Saranex	2	Producer B, commercial saran liner for low O2 ingress
Synthetic	Synthetic - Low O2	2	Synthetic injection molded, formulated for low O2 ingress. Target was natural cork
	Synthetic - Med O2	3	Synthetic injection molded, formulated for lower O2 ingress versus commercial
	Synthetic - Commercial	4	Synthetic injection molded. Commercial closure

Oxygen Sensitive Wine Data Gathering



- Blind tasting conducted every four months for two yrs. Final review at 39 months.
- Eight samples of each of the 10 closure treatments used in each tasting.
 - Samples taken randomly from the bottling line
 - All wines were put under closure on the line the same day
- Each flight tasted blind, randomly, three times

Oxygen Sensitive Wine Results

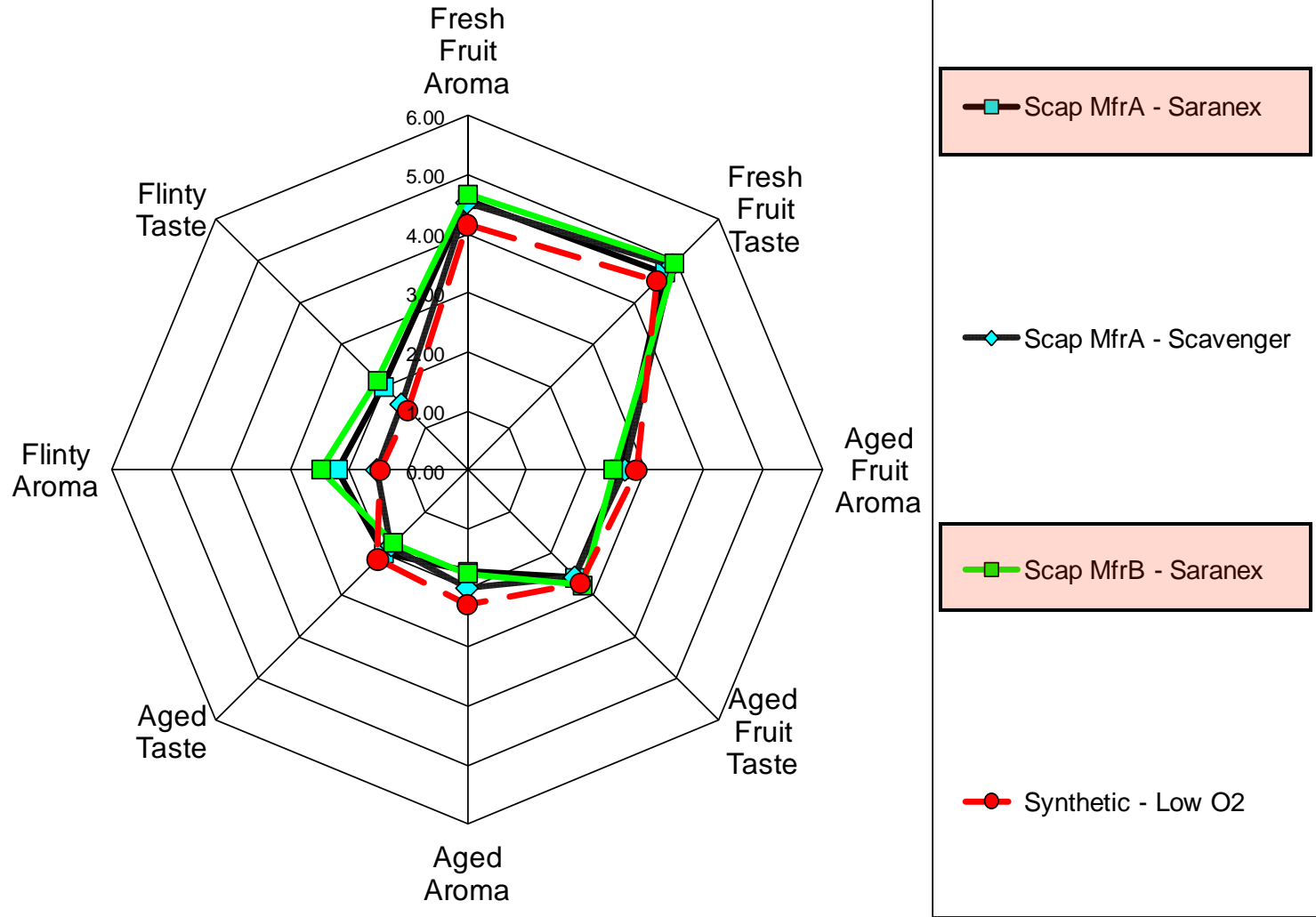
WHAT DID WE FIND?



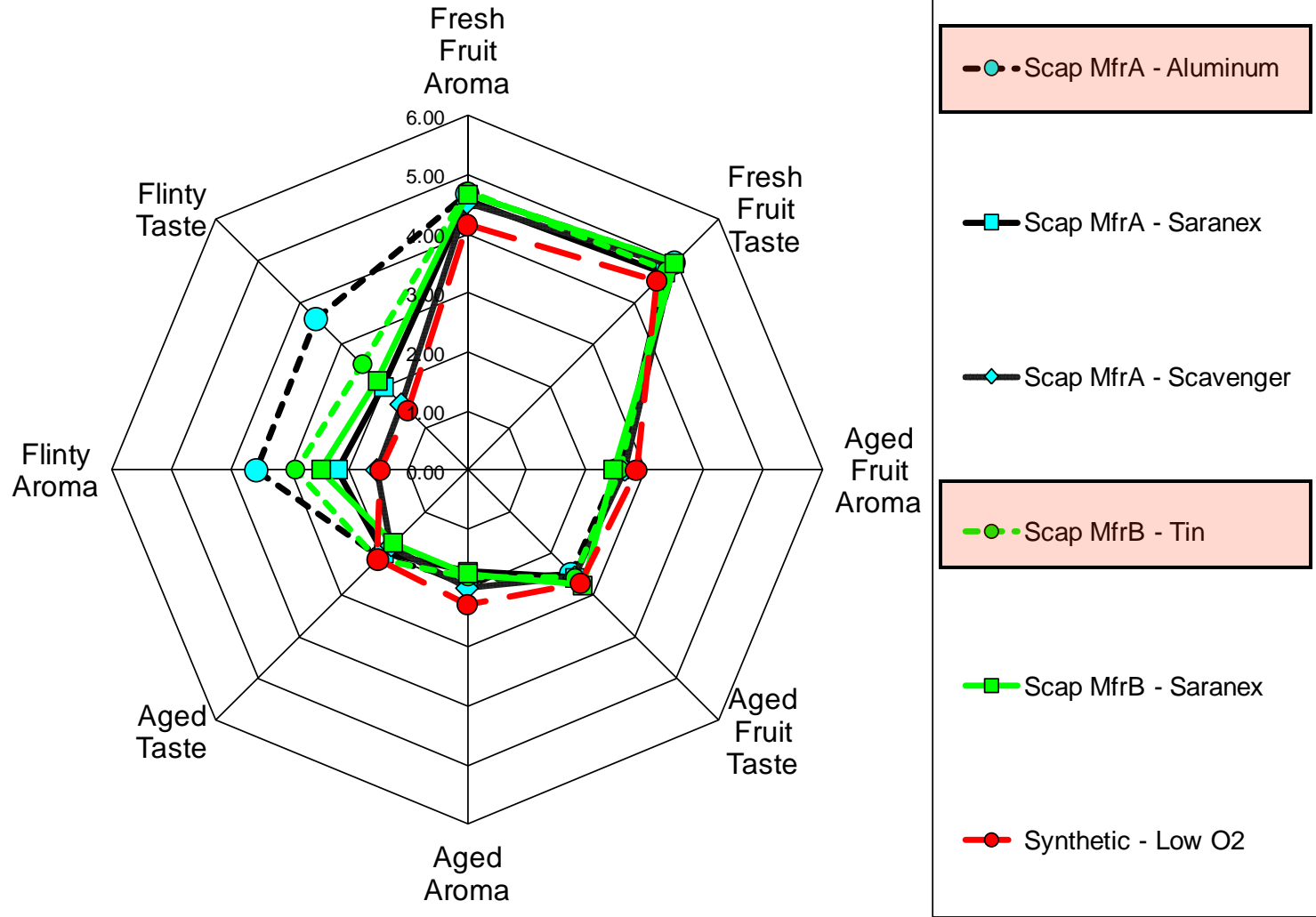
The Scorecard

- Wines were evaluated on a number of criteria.
 - Development
 - Fresh Fruit Taste
 - Aged Fruit Taste
 - Aged Taste
 - Flinty Taste
 - Free SO₂

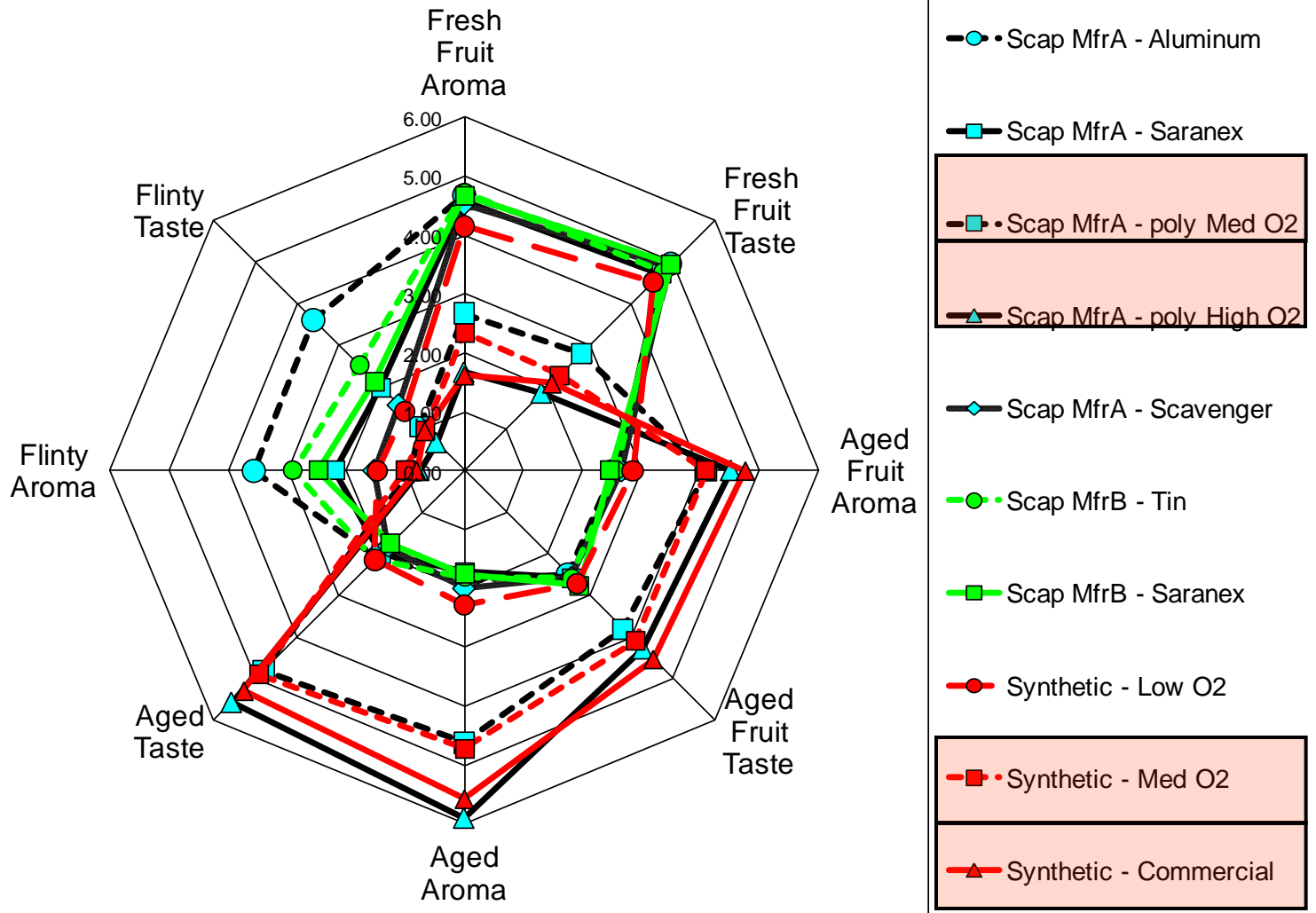
Wines sealed under a Saranex-lined screwcap showed fresh & fruity taste & aromas.



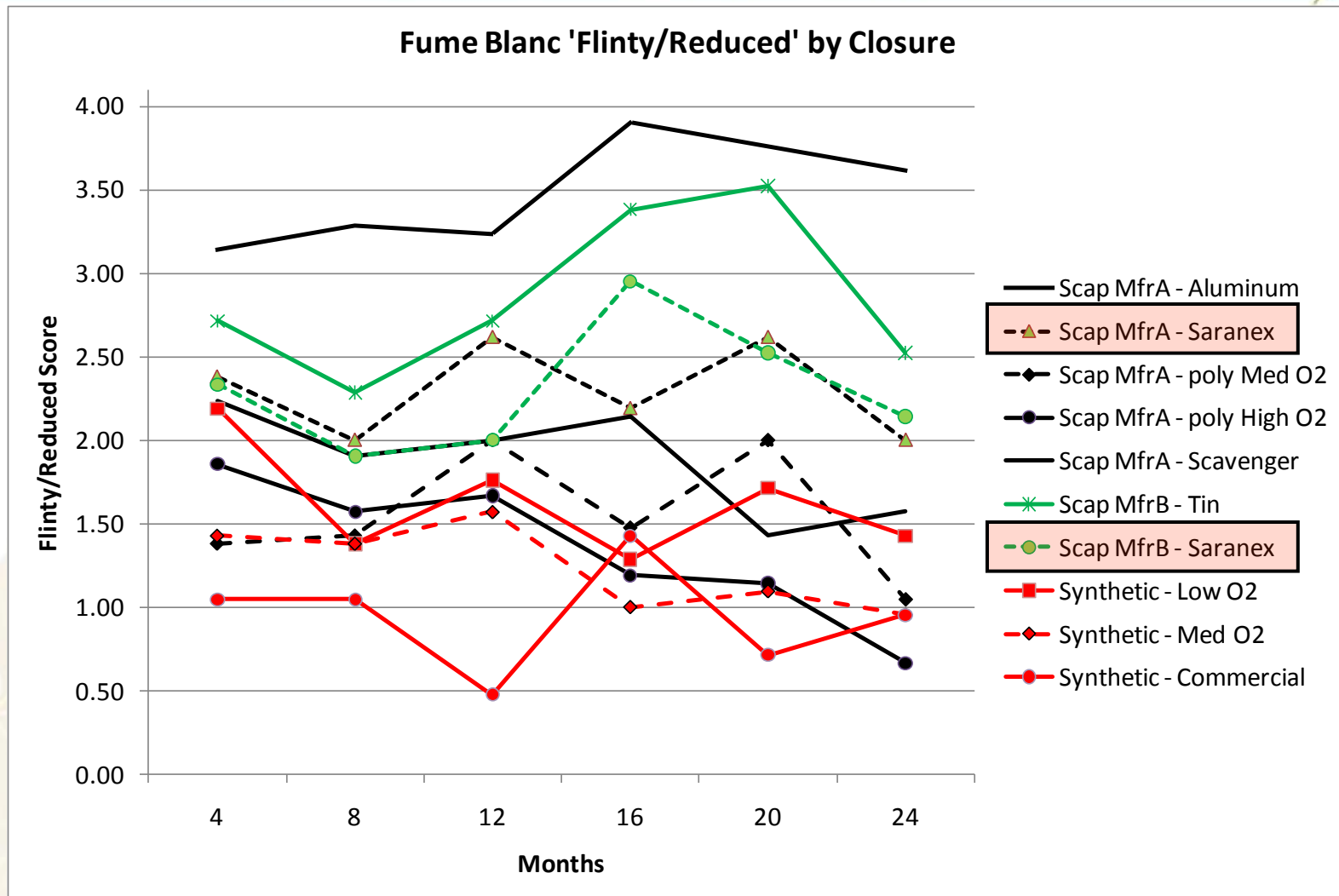
**Wines sealed under aluminum or tin-lined screwcaps showed flinty characters.
 Flinty = a smoky, gunpowder smell or taste.**



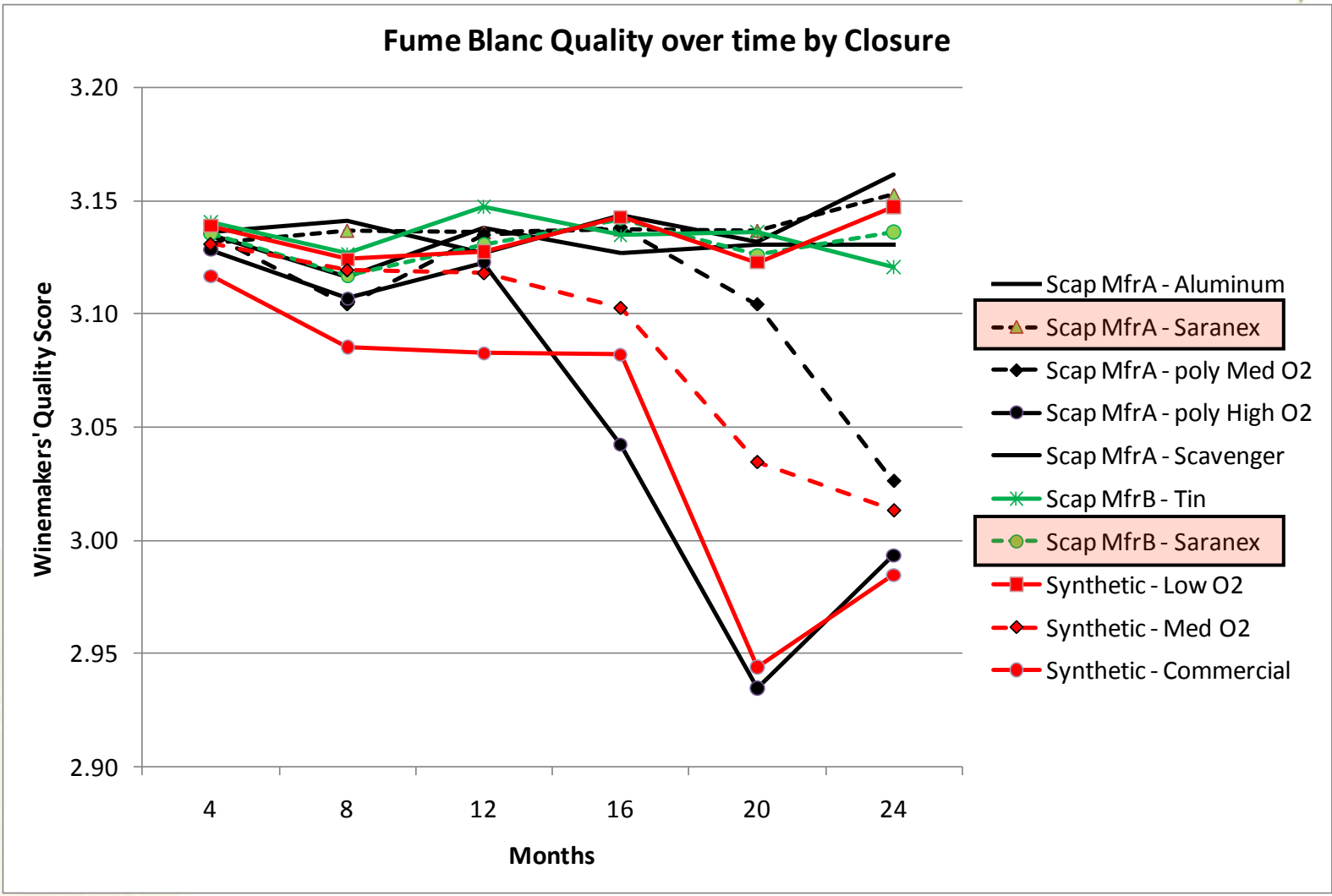
Wines sealed with a poly-lined high oxygen ingress or a synthetic closure showed age more quickly, exhibiting vinous, dried fruit or oxidative characters.



Over two years, wines under aluminum and tin-lined screwcap closures continued to show the most flinty or reduced characters.



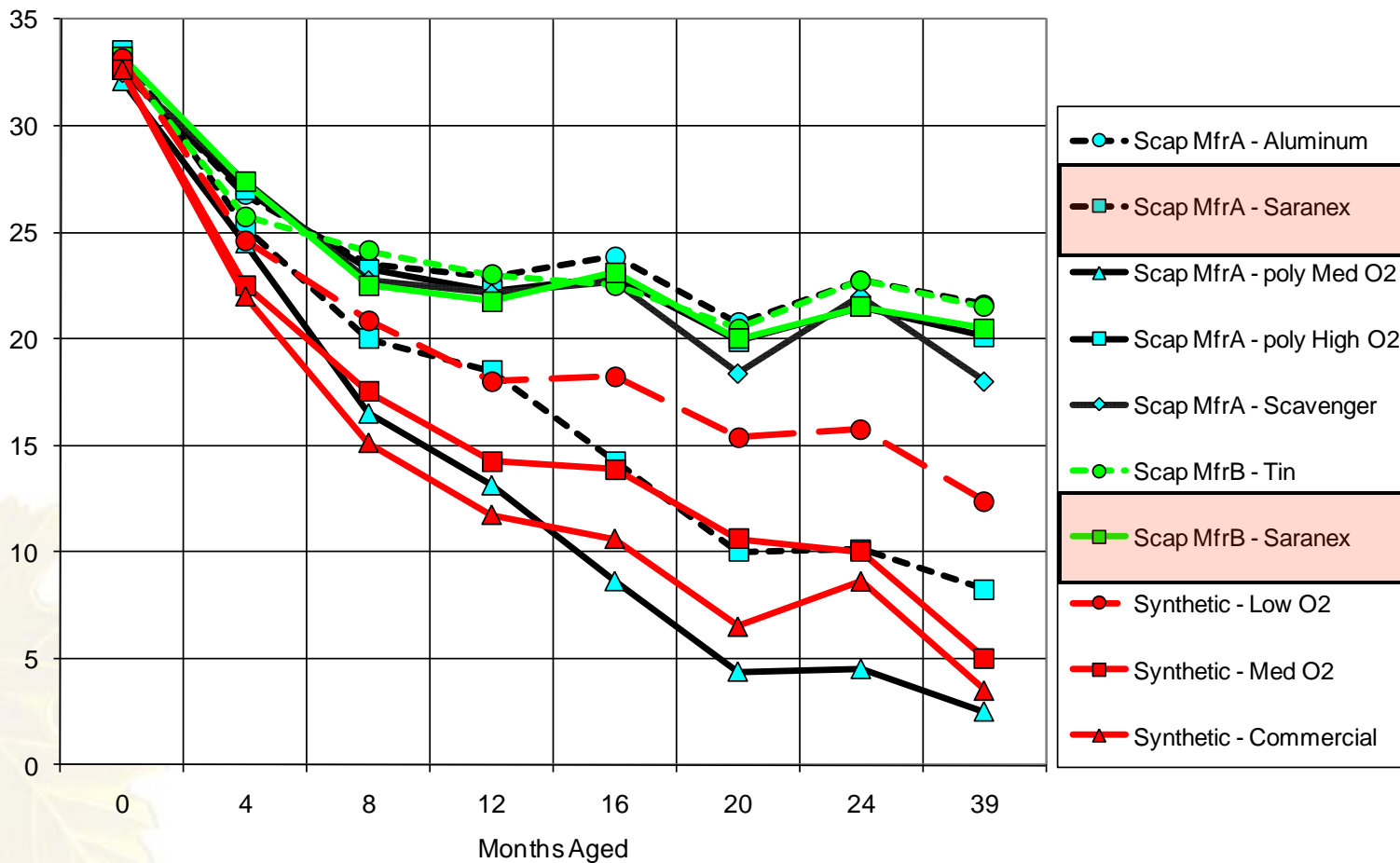
Closures which allowed excess oxygen into the bottle scored lower over time.



Saranex-lined screwcaps let in slightly more oxygen than tin or aluminum liners but still preserve free SO₂.



Sauvignon Blanc Free SO₂ by ripper. n = 8 bottles/treatment





IN CONCLUSION...

Fumé Blanc Study (Oxygen Sensitive Wine) Summary of Results



- Very low oxygen ingress closures can result in 'reductive' wine qualities.
 - Screwcaps with metal-based liners did not perform as well. Reduction showed early and persisted.
- Low to moderate oxygen ingress closures, like screwcaps with Saranex liners are OK!
 - Look to free sulfur dioxide (SO₂) consumption over time to determine best choice.
- High oxygen ingress closures like synthetic closures make wines age more quickly
 - Aged character begins to show around 10 parts per million of free SO₂.

Part Two – Wines of differing vintages and oak aging programs.

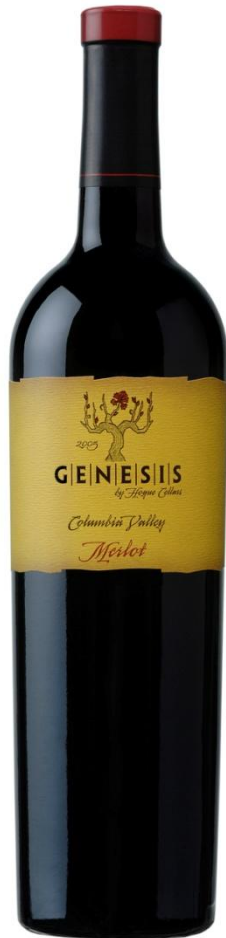
A TALE OF TWO MERLOTS



A Tale of Two Merlots

One aged Merlot

HOGUE



2003 Genesis Merlot

- 19 months barrel age
- Bottled in 21 months
- Big and balanced
- All wines bottled on the Hogue commercial bottling line at steady-state rate of oxygen exposure.

A Tale of Two Merlots

One early to bottle Merlot

HOGUE



2004 Hogue Merlot

- Tank staves & micro-oxygenation
- Bottled in 10 months
- Tannic
- All wines bottled on the Hogue commercial bottling line at steady-state rate of oxygen exposure.

Merlot Study Closures



9 Different Closures - INCLUDING CORK!
No screwcaps with tin liners as they don't let in enough oxygen.

Closures used in Merlot Trials		
Class	Closure	Treatment
Natural	Natural Cork	Standard production natural cork, purchased and printed for Genesis Merlot
Screwcap	Scap MfrA - Saranex	Producer A, polymer low-ingress (Saran) liner product
	Scap MfrA - poly Med O2	Producer A, experimental liner - Polyester foam for increased O2 ingress
	Scap MfrA - poly High O2	Producer A, experimental liner - Polyethylene foam for higher O2 ingress
	Scap MfrB - Saranex	Producer B, commercial saran liner without Nitrogen headspace voided
	Scap MfrB - Saranex w/ N2	Producer B, commercial saran liner with Nitrogen headspace voided
Synthetic	Synthetic - Low O2	Synthetic injection molded, formulated for low O2 ingress. Target was natural cork
	Synthetic - Med O2	Synthetic injection molded, formulated for lower O2 ingress versus commercial
	Synthetic - Commercial	Synthetic injection molded. Commercial closure

Two Merlots – Different Age & Vinification

Data Gathering



- Blind tasting conducted every 12 months for five years. Eight samples of each closure treatment used in each tasting.
 - Samples taken randomly from the bottling line
 - All wines were put under closure on the line the same day
 - Wines under cork closure were pre-screened for taint and if tainted, removed prior to blind tasting.
- Professionally trained tasting panel of seven people
 - Each flight tasted blind, randomly, three times

The Scorecard



Wines were evaluated on a number of sensory criteria:

- Score
- Development
- Cork Aroma
- Fruit Aroma
- Reduced Aroma
- Cork Taste
- Reduced Taste
- Fruit Taste
- Free SO₂
- CO₂ levels

Two Merlots – Different Age & Vinification

Sensory Evaluation

- Wines were evaluated on their development in bottle using the following parameters:
 - Underdeveloped- tight, closed, reduced
 - Just right – showing as properly expressive, drinkable, fruity and pleasant.
 - Overdeveloped – aged character, oxidized



Two Merlot Wines, Different Age & Vinification

WHAT DID WE FIND?

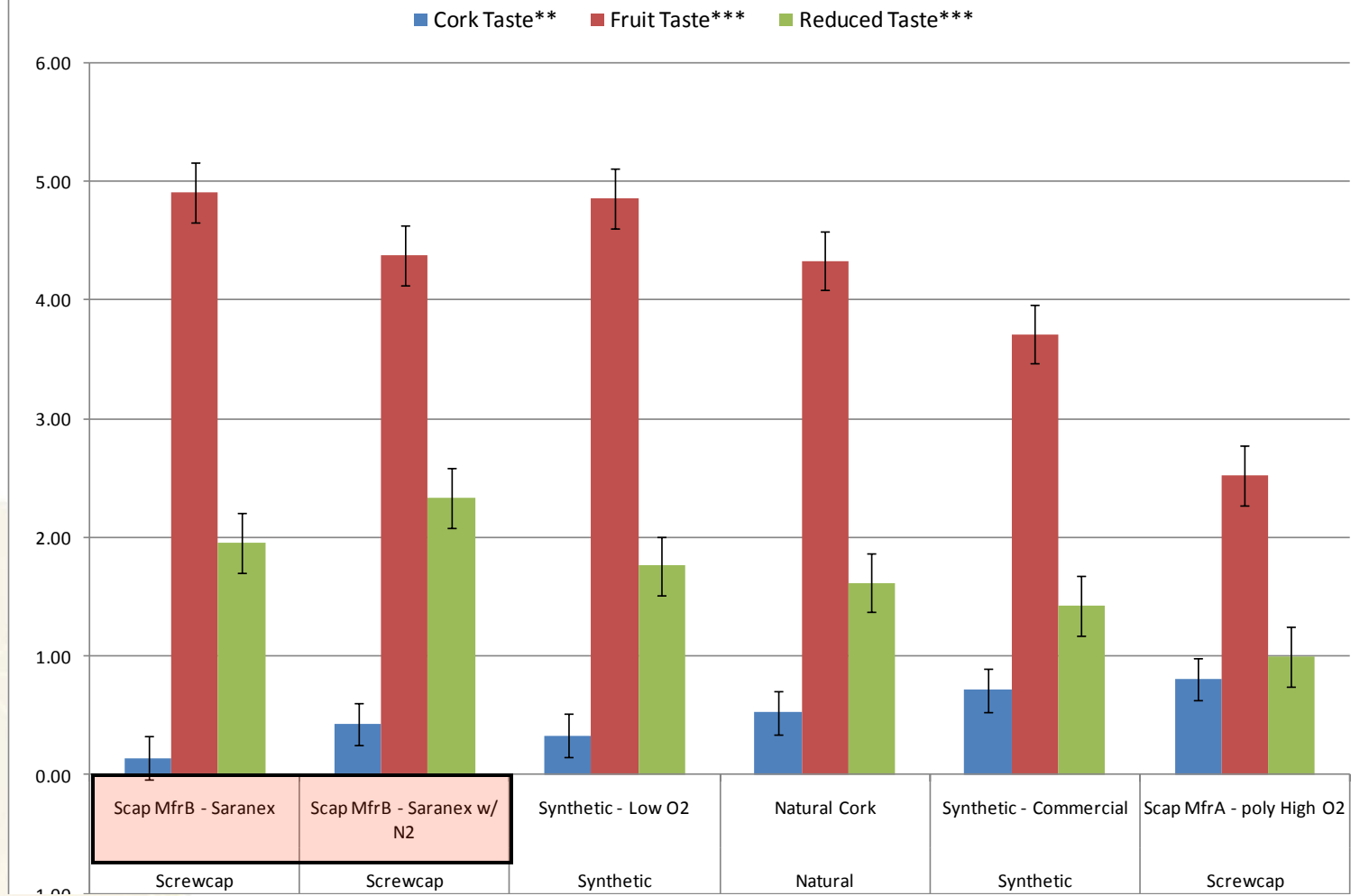


2003 Genesis Merlot – Sensory Evaluation

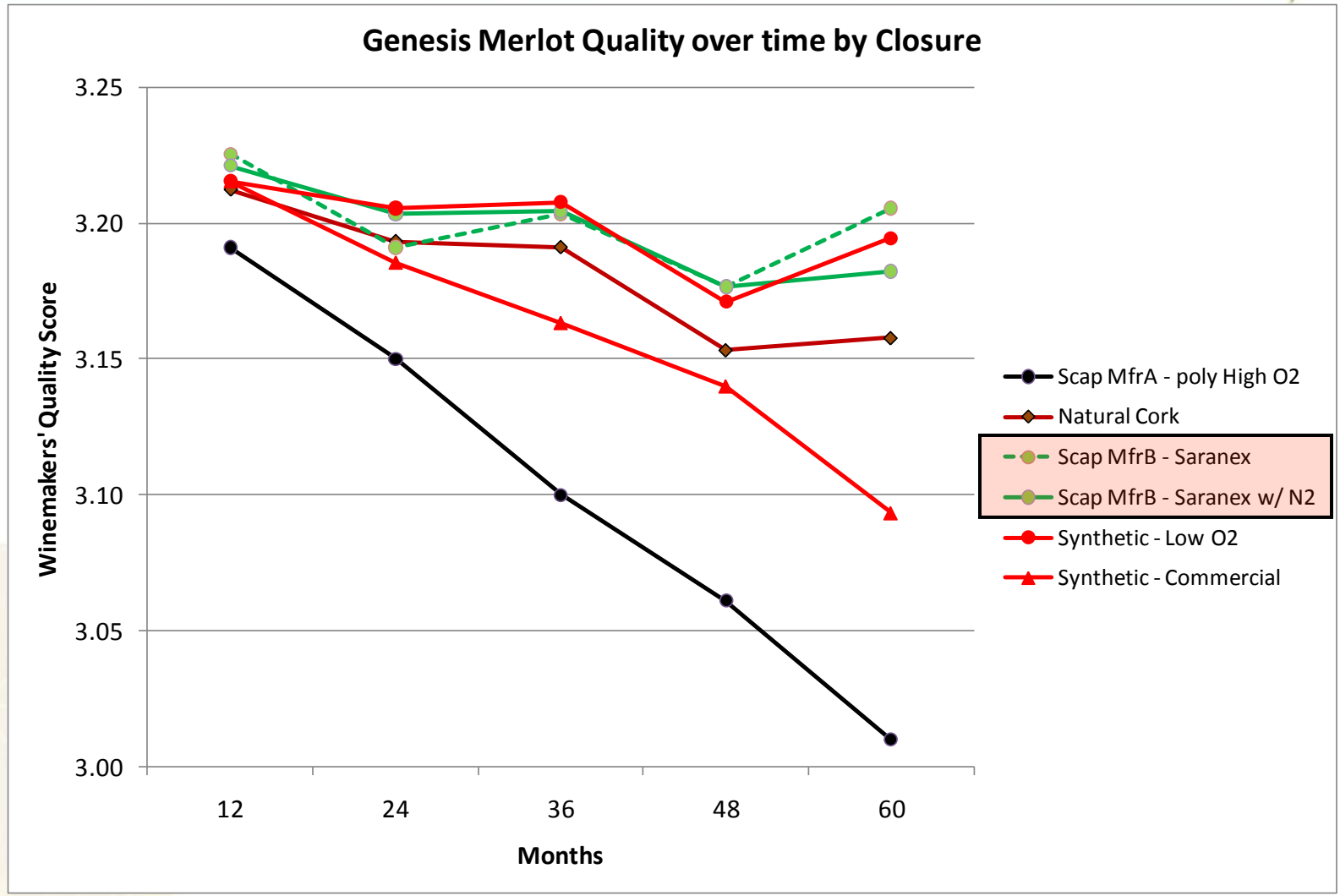
After five years, Genesis Merlot closed under Saranex-lined screwcap were showing more fruit intensity, no cork taste and reduced taste similar to wines sealed in cork.



Genesis Merlot Sensory Results @ 60 Months



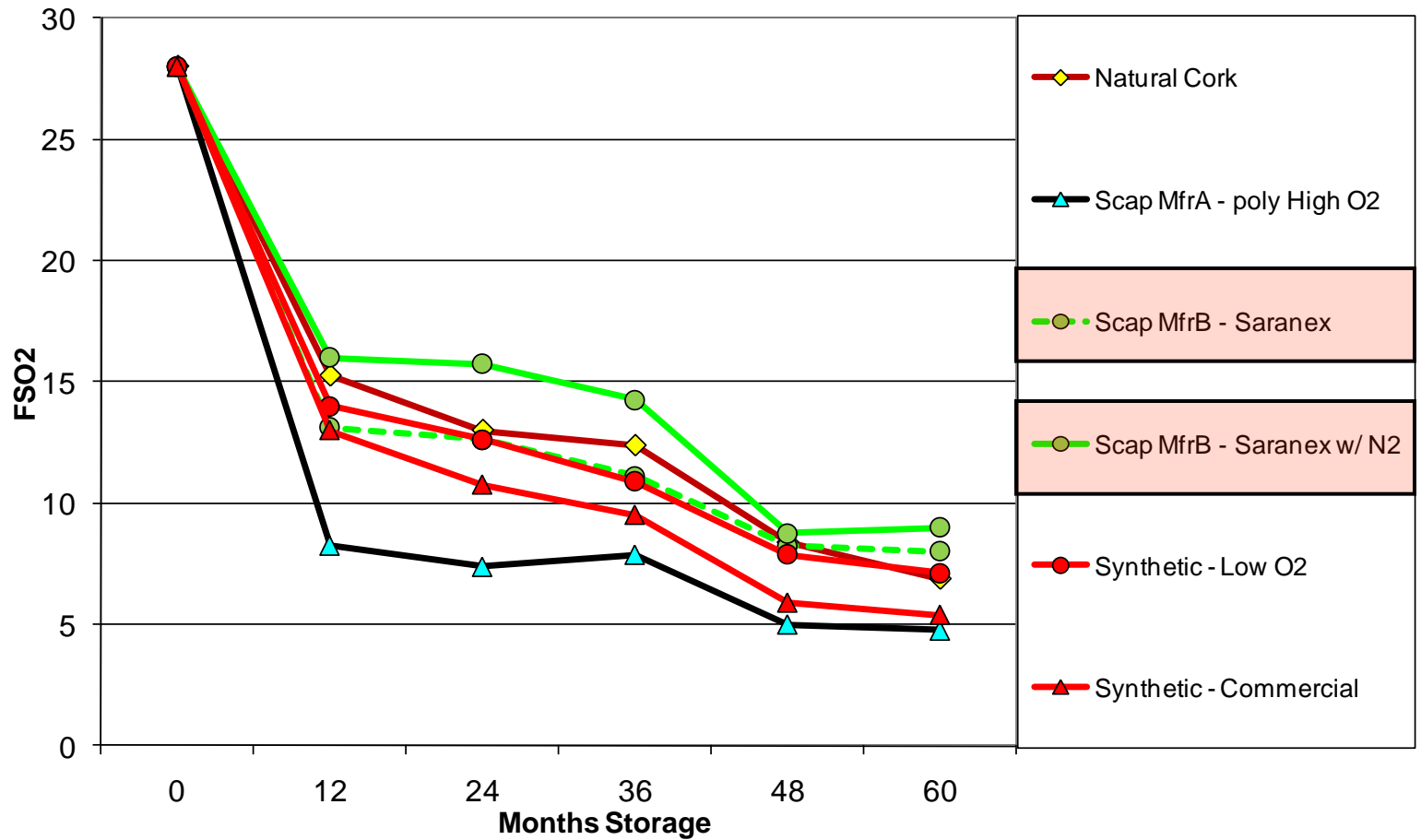
Saranex liners proved to perform best over five years while natural cork didn't fare as well. One synthetic closure also performed well, but it is no longer commercially available.



Saranex-lined screwcaps preserved the wine better over time than natural cork and synthetics.



Genesis Merlot FSO2 (ripper) by closure. n=8 bottles/treatment



2003 Genesis Merlot Summary (Barrel-Aged Merlot)

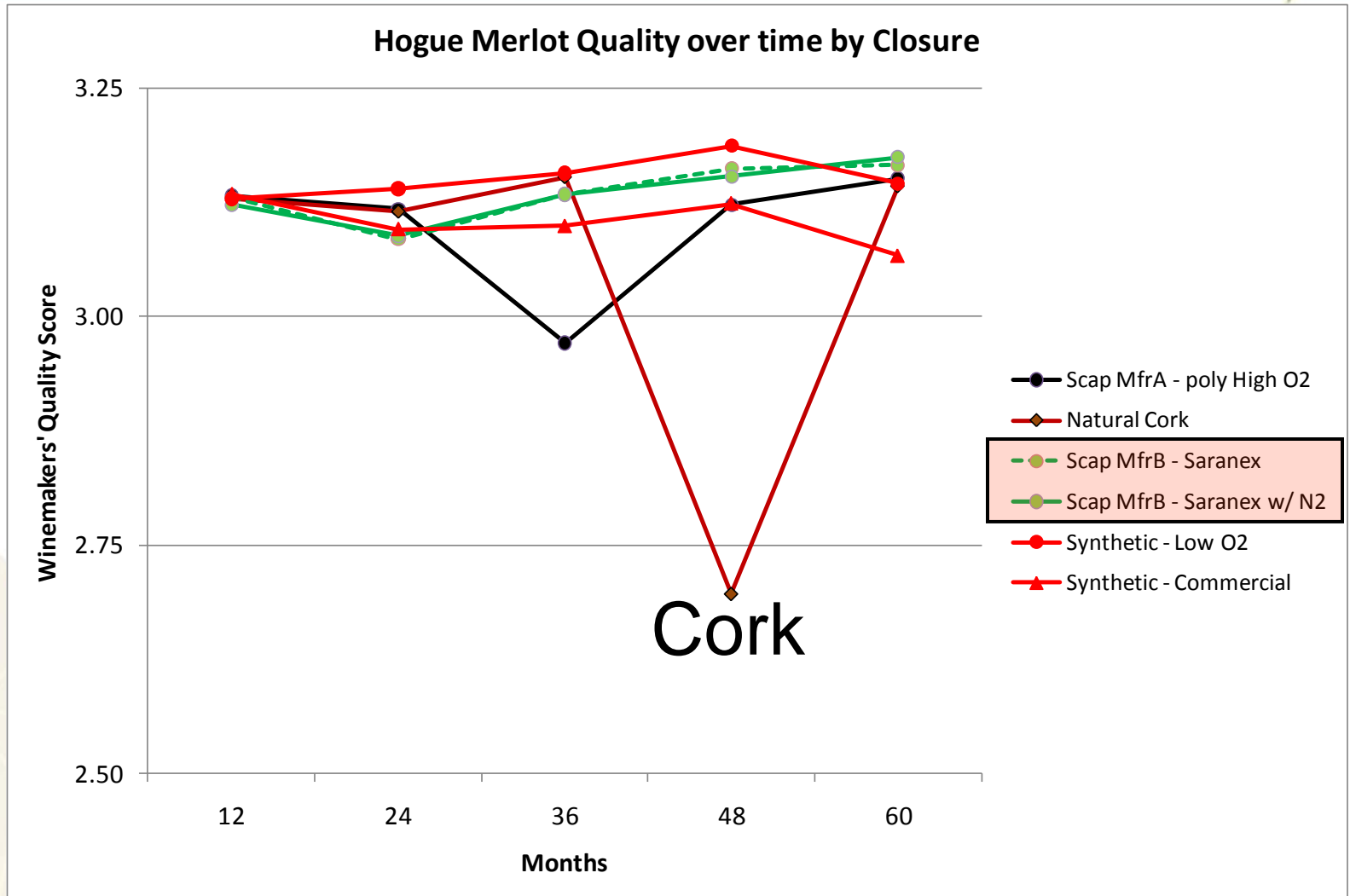


- Results were similar to what we discovered in the Sauvignon Blanc study
 - Lower oxygen ingress closures retained quality regardless of closure class
 - Fruit intensity degraded w/ higher oxygen ingress closures such as synthetic.
- Nitrogen dosing headspace matters
 - Highest quality preference was at 24 months
 - Less preference was at 60 months
 - While the differences are small, when it comes to fine tuning our wines, we feel no nitrogen in headspace is best for red wines.

Early to Bottle Merlot

2004 HOGUE MERLOT STUDY

Once again, Hogue Merlot was showing very nicely in bottle after five years under saranex-lined screwcap. But what happened to cork?!



An error in the process! 48 months into the study, our screeners forgot to pre-screen for cork taint prior to our blind tasting.



However, this did not affect the overall results of the study.

Closure	Months	Rep 1	Rep 2	Rep 3
SC1 - Saranex++	24	0.7	0.3	1.3
	36	0.7	0.0	0.3
	48	0.0	0.3	0.3
	60	0.3	0.0	0.3
Natural Cork	12	0.7	0.7	1.3
	24	0.3	0.3	0.3
	36	0.0	0.0	0.0
	48	2.0	8.3	7.7
	60	0.3	0.3	0.0
SC2 - Saranex	12	0.3	0.7	0.3
	24	1.0	2.0	0.7
	36	0.0	0.7	0.7
	48	0.0	0.7	0.3
	60	1.0	0.0	0.0
SC2 - Saranex w/ N2	12	0.3	1.0	0.7
	24	1.0	1.3	1.0
	36	0.3	0.0	0.0
	48	1.3	1.0	0.3
	60	0.3	0.0	0.0
Synth - Low O2	12	0.3	0.3	0.7
	24	0.7	0.3	0.3
	36	0.3	0.7	0.0
	48	0.3	0.7	0.3
	60	0.7	0.0	0.7
Synth - Commercial	12	0.3	1.7	0.7
	24	0.7	0.3	0.7
	36	0.0	0.0	0.0
	48	0.7	0.3	1.0
	60	0.3	0.0	0.0

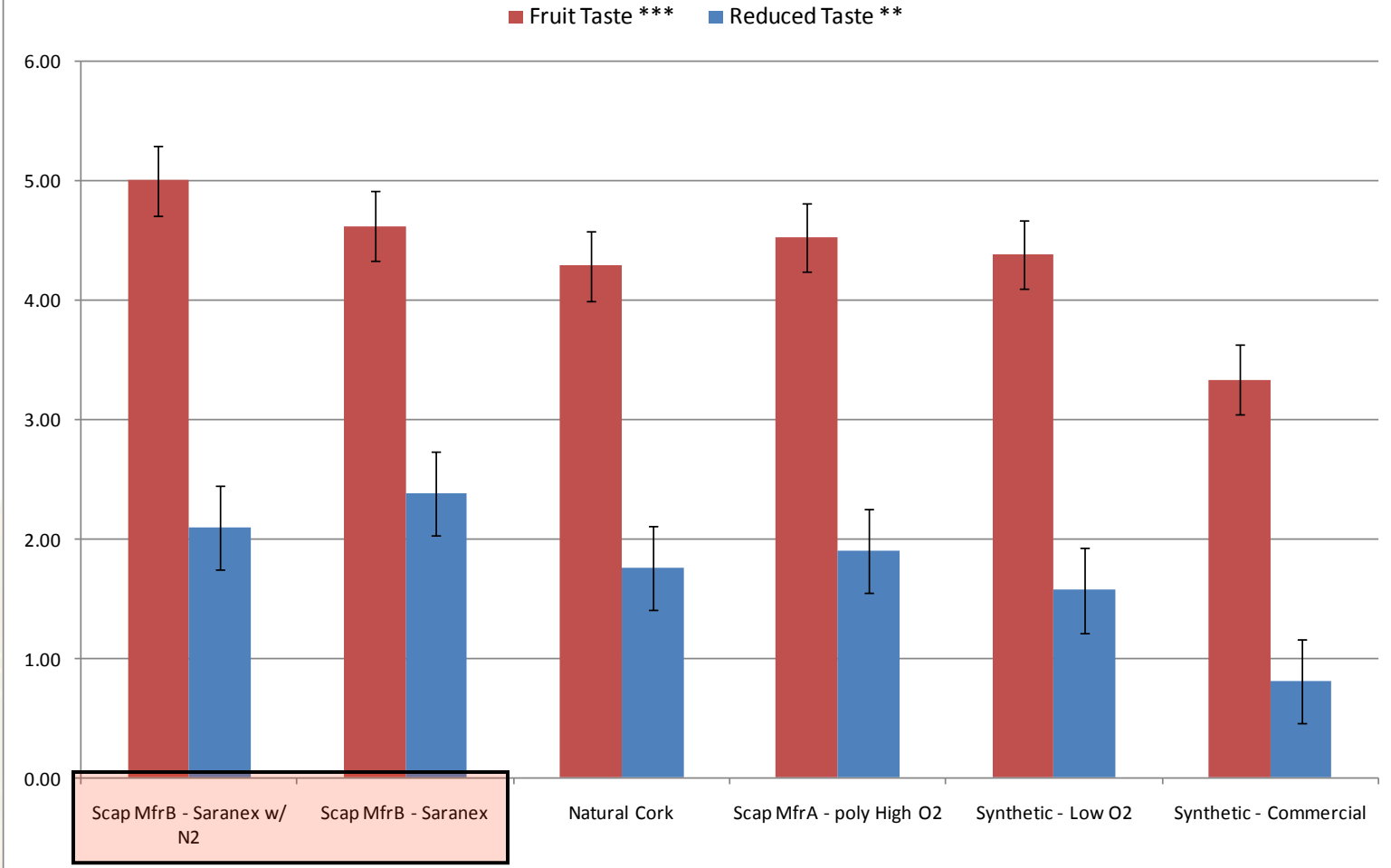


Sensory Criteria Evaluation

Hogue Merlot closed under saranex-lined screwcap were showing the best. For this wine, however, high oxygen ingress closures performed relatively well.



Hogue Merlot Sensory Results @ 60 Months



Hogue Merlot Summary



- Again, saranex-lined screwcaps performed well overall
- High oxygen ingress closures did better on this wine. Why? We believe this is because the other two study wines were more bottle ready. This Hogue Merlot was
 - Heavily bodied & tannic
 - Bottled at 10 months post-harvest
 - Still had some natural capacity for oxygen!

Following this we adjusted our winemaking to ensure that all Hogue line reds are more open and expressive at bottling.

The study has resulted not only in more knowledge about screwcap performance in red wines but has also allowed us to improve our winemaking for wines bottled in screwcap.



**SO WHAT DOES ALL OF THIS
TELL US ABOUT WINE AGING
UNDER SCREWCAP?**

We need to change our perception!



- Screwcaps are as good or better than natural cork.
 - Not all screwcaps are created equal.
 - The Hogue Cellars wines age well under the appropriate screwcap.
-
- Closure **class** doesn't drive quality
 - There are some BAD screwcaps and synthetics
 - There are some GOOD screwcaps and synthetics
 - Closure **characteristics** drive quality

We need to change our perception!

- This study shows that wines aged under the right screwcap closure over five years were more well preserved, aged well and were deemed the highest quality choice by an expert tasting panel.
- As a result of these findings, The Hogue Cellars will move the remainder of its production, including its premium tiers Genesis and Reserve, to screwcap closures with saranex lining.
- Beginning with the 2009 vintage, all Hogue Cellars wines will be under screwcap.

THOSE ARE THE FACTS ABOUT SCREWCAPS!

www.twistopenhogue.com

www.hoguecellars.com

