

A Successful Application of Chemical Cork Screening Methods



Cork Quality Council
www.corkqc.com

History of GC/MS Usage by the CQC



Completed Primary Research at ETS in 1999

Initiated Full-Scale Cork Screening in 2000

**Replaced Sensory Analysis as Standard
Method of Screening for TCA in 2001**

**Installed Similar Equipment at Primary
Production Facilities 2001-2002**

**Adopted Lot Acceptance Criteria in Addition to
Bale Acceptance Criteria - 2005**



Cork Soak Statistics – since 2000

Total Corks Soaks Performed	95,567
Individual Corks Soaked	4,778,350
Gallons of Wine Used	114,680
Associated Expense	\$4,705,515



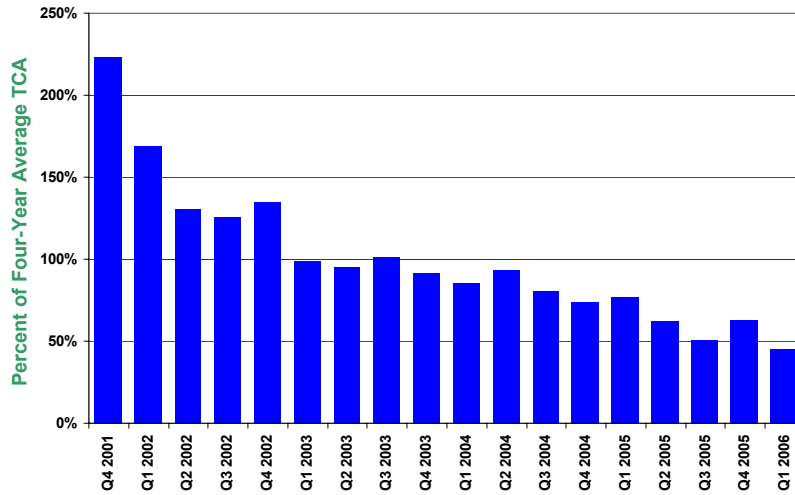
Results ?

- Better Understanding of the Behavior of TCA, Corks and Bottled Wine
- Ability to use Group Cork Soaks to Expand Sample Sizes When Evaluating Cork Populations
- Acquired the Ability to Evaluate Cork Quality Beyond Sensory Limitations
- Established an Objective Criteria to Evaluate Cork Quality with Suppliers and Customers
- Helped Primary Manufacturers Evaluate New Production Methods

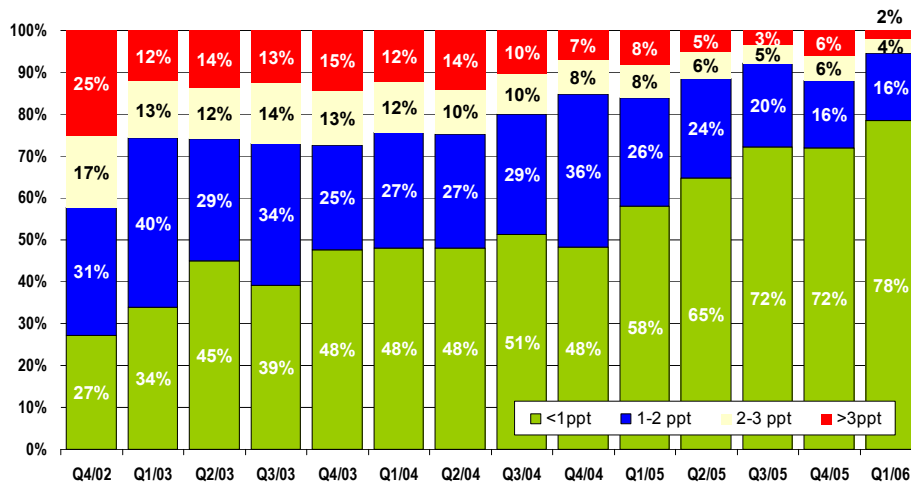
Cork Quality Shows Steady Improvement



Average TCA Scores from Incoming QA Screening Have Improved by 80% in the Past Four Years



94% of TCA Scores from Incoming QA Screening Are Now Under 2ppt



Natural Corks



Reasons for Improvements

Established Objective Quality Standards

Improved Manufacturing Techniques

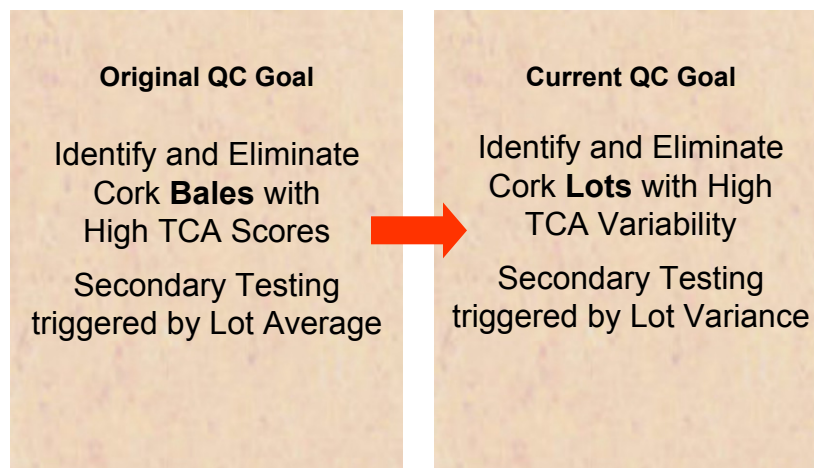
- Improved Material Handling
- On-site Chemical Analysis

Informed Material Sourcing

Market Forces

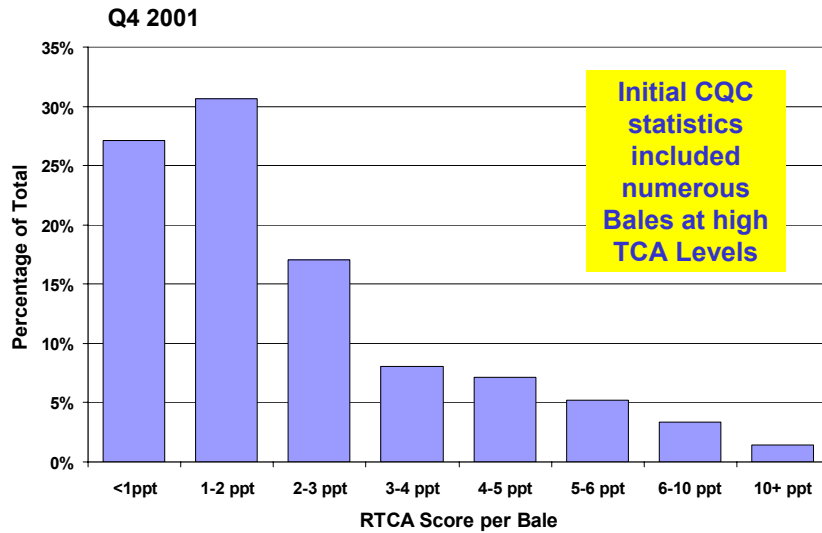


Transition in Screening Goals

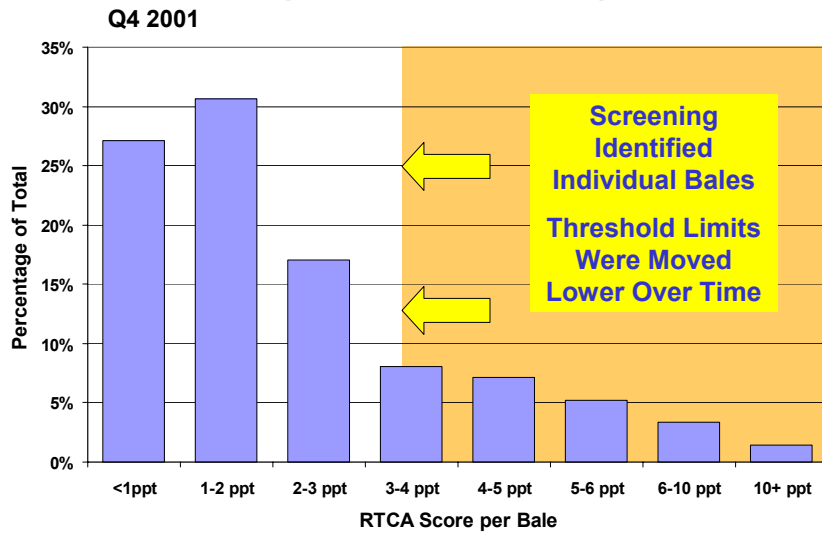




Initial Population Statistics

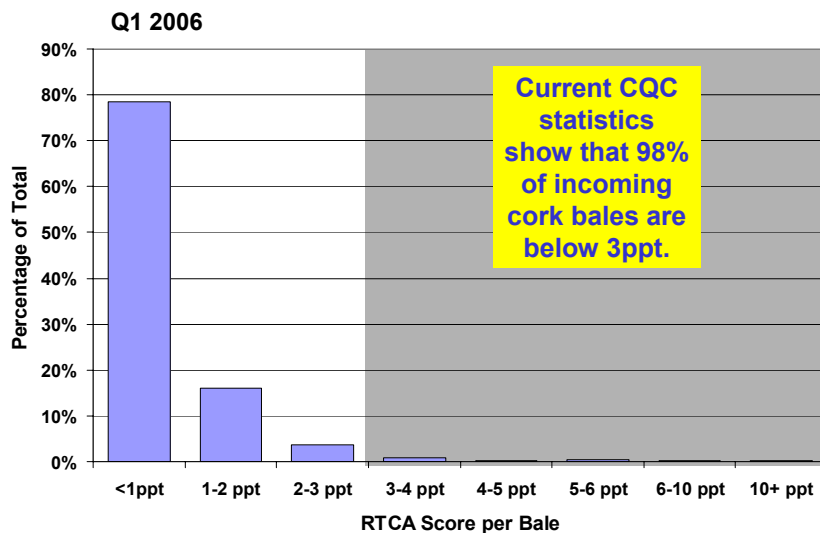


Initial Screening – To Remove High Scores

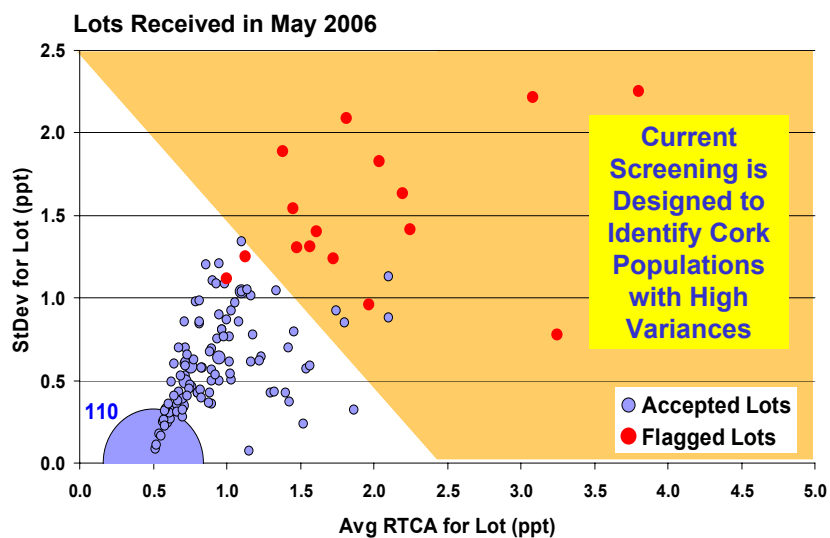




Current Population Statistics

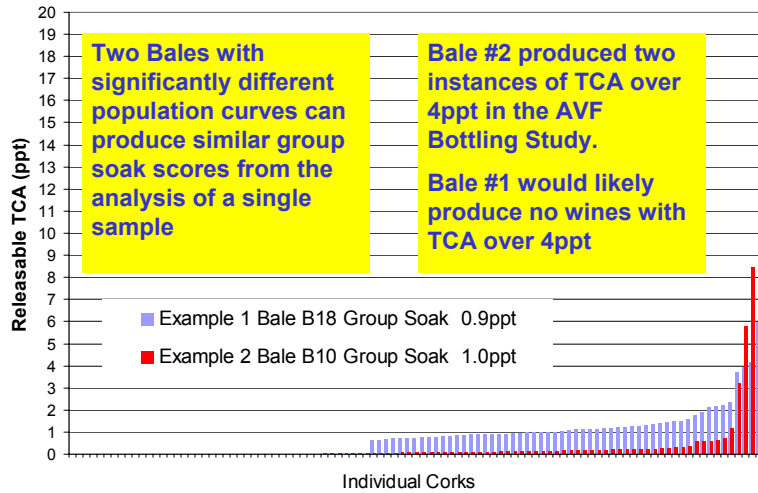


Current Screening – To Reduce Outliers





Two Population Curves Produce Different Patterns of Variance over Multiple Soaks



New Protocol - Lot Acceptance Standard

- Designed to Identify Cork Lots with Low Averages but Multiple Outliers
- Recognizes that Individual Cork Lots have Greater Homogeneity than the General Population
- Uses a Secondary Sampling Step when Suspicious Bales are Encountered.
- An Entire Lot is Accepted or Rejected Based on the Variance Displayed – Regardless of the Number of Low Scores.



New CQC Minimum Sampling Standard

For all incoming natural corks.
 Lots consist of same grade/treatment/supplier and shipment
 Maximum Lot Size is 250,000 corks

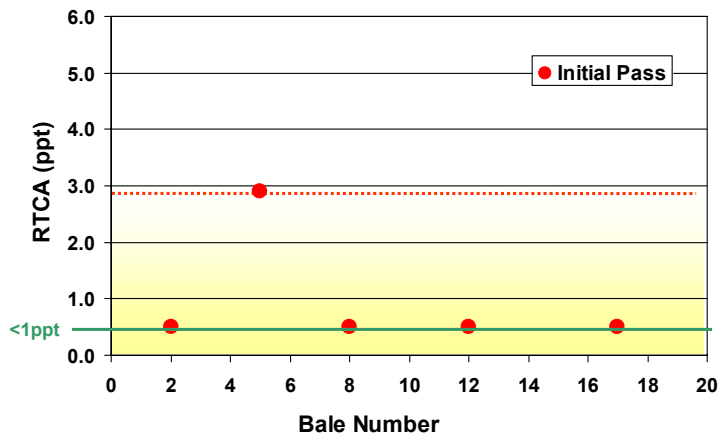
NUMBER OF BALES		1	2-8	9-15	16-25	26-50	CRITERIA
SPME TESTING	REQUIRED						
Initial Bale Samples	for all natural corks	1	2	3	5	8	Mil Std 105E-ISO2859-1 (L2)
Accept/Reject		0/1	0/1	0/1	0/1	1/2	Flag @ AQL 4.0
Additional Samples	Conditional	na	3	5	8	13	Mil Std 105E-ISO2859-1 (L3)
Accept/Reject	on Initial Results	na	0/1	0/1	1/2	1/2	Flag @ AQL 4.0



CQC Screening Protocol Example A – Initial Pass

Bale	#1
1	
2	<1
3	
4	
5	2.9
6	
7	
8	<1
9	
10	
11	
12	<1
13	
14	
15	
16	
17	<1
18	
19	
20	

50-Cork Samples taken from Cork Lot of 20 Bales

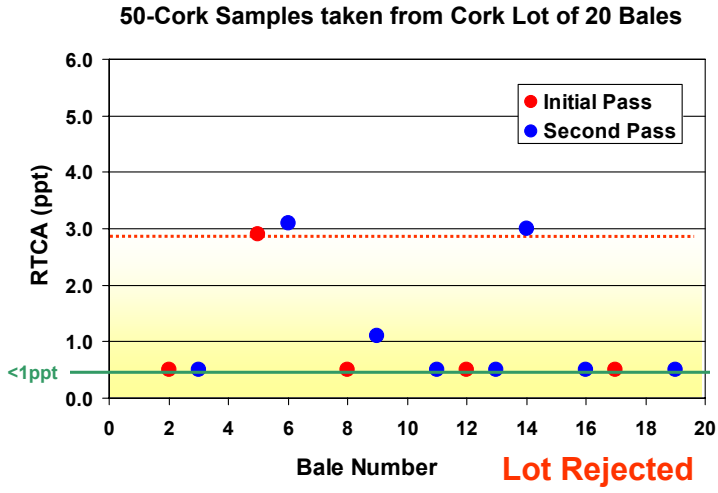


Samples 5 Average Score 1.0ppt Standard Deviation 1.07



CQC Screening Protocol Example A – Second Pass

Bale	#1	#2
1		
2	<1	
3		<1
4		
5	2.9	
6		3.1
7		
8	<1	
9		1.1
10		
11		<1
12	<1	
13		<1
14		3.0
15		
16		<1
17	<1	
18		
19		<1
20		



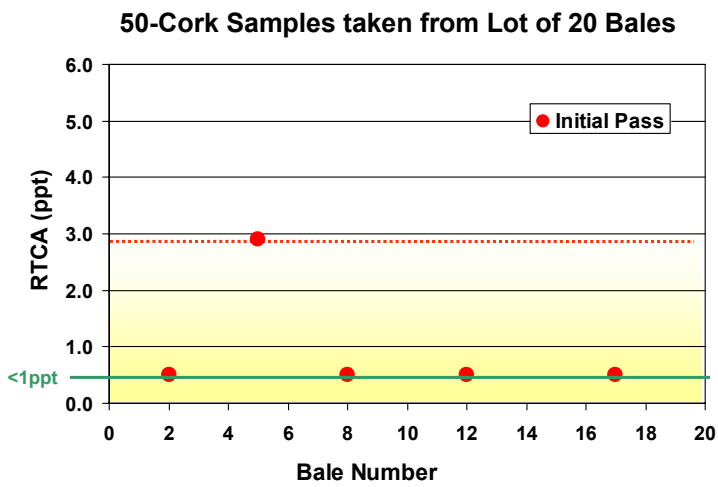
Samples 13 Average Score 1.1ppt Standard Deviation 1.08

Lot Rejected



CQC Screening Protocol Example B – Initial Pass

Bale	#1
1	
2	<1
3	
4	
5	2.9
6	
7	
8	<1
9	
10	
11	
12	<1
13	
14	
15	
16	
17	<1
18	
19	
20	

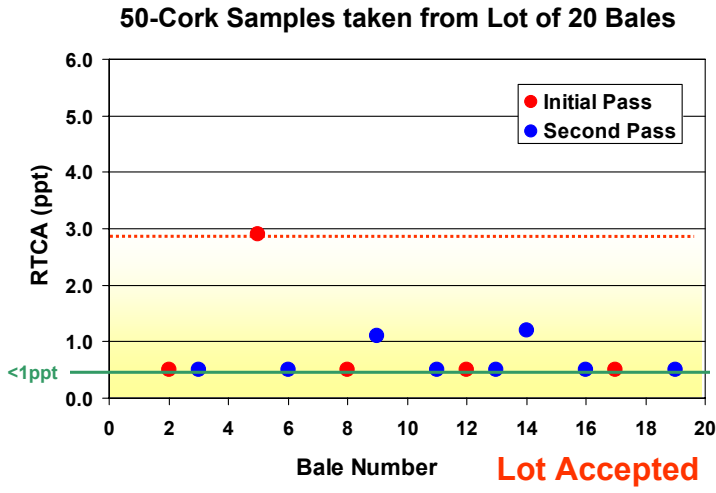


Samples 5 Average Score 1.0ppt Standard Deviation 1.07



CQC Screening Protocol Example B – Second Pass

Bale	#1	#2
1		
2	<1	
3		<1
4		
5	2.9	
6		<1
7		
8	<1	
9		1.1
10		
11		<1
12	<1	
13		<1
14		1.2
15		
16		<1
17	<1	
18		
19		<1
20		



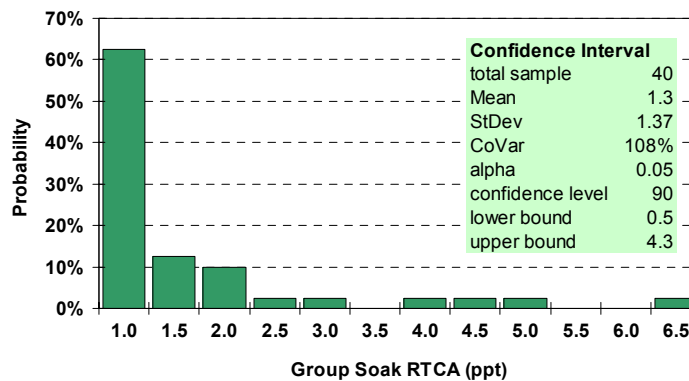
Samples 13 Average Score 0.8ppt Standard Deviation 0.87



Example: High Variance Bale at 2.0ppt Lot Average

Bale	#1
1	
2	1.6
3	
4	
5	5.2
6	
7	
8	1.7
9	
10	
11	
12	<1
13	
14	
15	
16	
17	1.2
18	
19	
20	

Results of 40 Different 50-Cork Soaks from a Single Bale out of a “Noisy” Lot



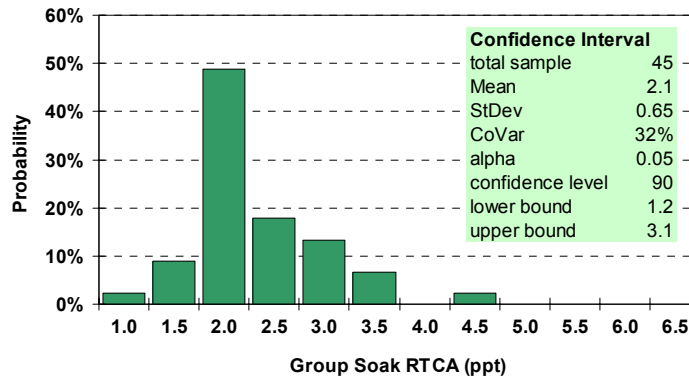
Original Sample of 5 Bales
 Samples 5 Average Score 2.0ppt Standard Deviation 1.83



Example: Low Variance Bale at 1.9ppt Lot Average

Bale	#1
1	
2	1.8
3	
4	
5	2.4
6	
7	
8	1.6
9	
10	
11	
12	2.1
13	
14	
15	
16	
17	1.7
18	
19	
20	

Results of 45 Different 50-Cork Soaks from a Single Bale out of a "Steady" Lot



Original Sample of 5 Bales

Samples 5 Average Score 1.9ppt Standard Deviation .33

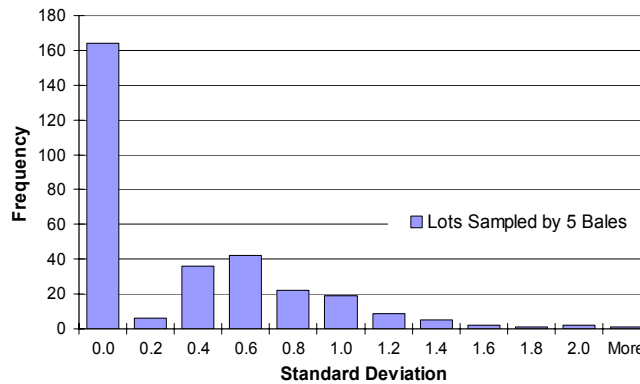


What is the Average Variance within a Lot?

In a review of 309 lots tested this year with exactly 5 samples per lot -

- 164 (53%) had a no variance – as all scores were less than 1ppt
- The remaining lots averaged an approximate 0.5ppt standard deviation

Range of Standard Deviations Found by Selected Lots (2006)





Interpreting SPME Data at the Winery

The analysis is designed screening tool – not as a definitive statistical summary

- Do not rely on a single TCA score.
- Ask your cork supplier for TCA information from the entire lot.
- Beware of patterns showing multiple instances of variance greater than 1ppt
- An isolated high score may foretell a highly variable lot – but it is often a true outlier that cannot be replicated