



THE SCIENCE OF BEER

Running a Sensory Program in a Multi-Facility/Multi-Beverage Facility

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June 4, 2014

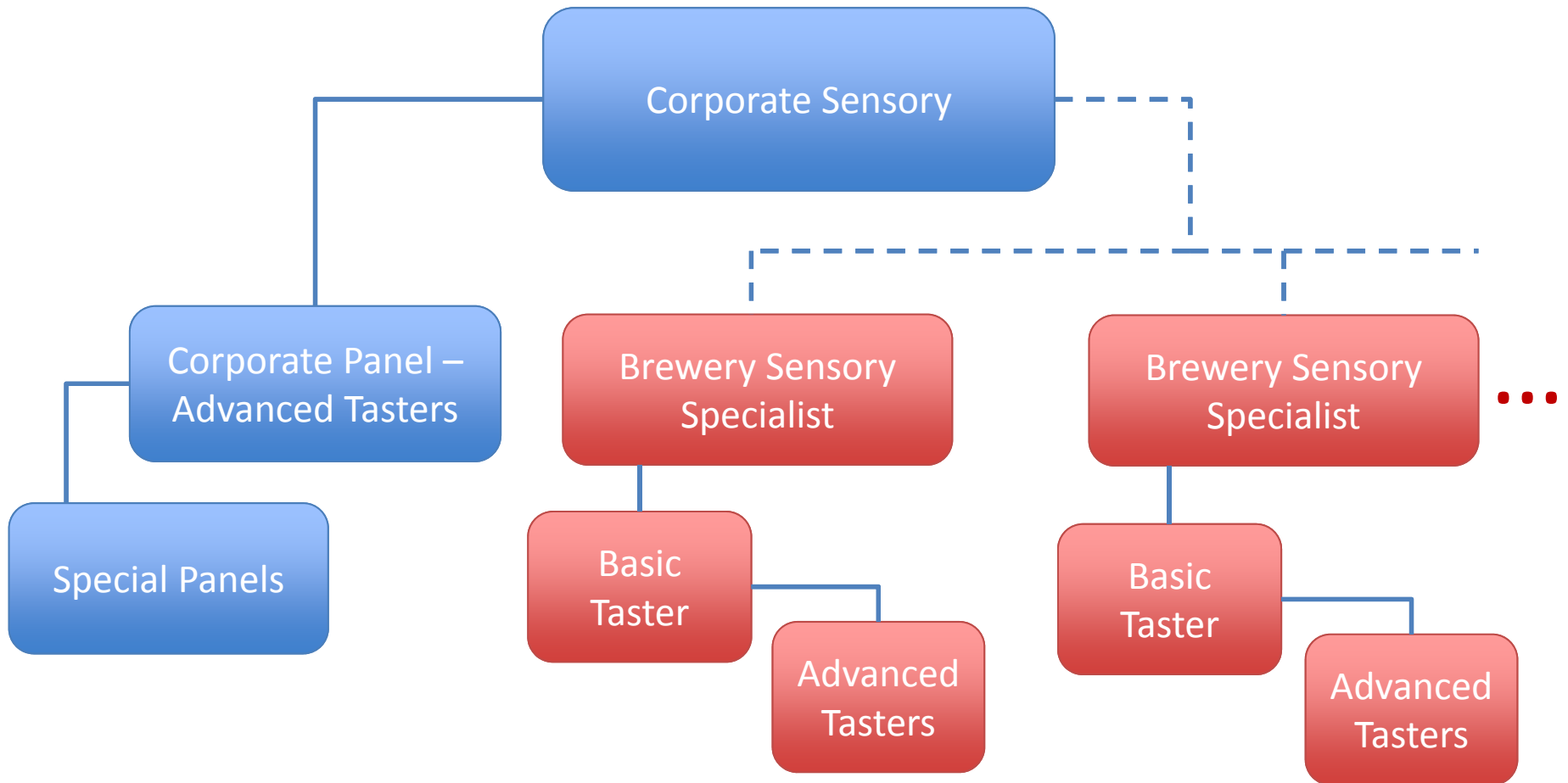


Outline

- Sensory Structure and Responsibilities
- Standardization of Training, Methods and Procedures
- Validation of Taste Panels
- Measuring Panel Performance
- Facility Audits
- Taste Performance as a Quality Metric



Sensory Structure



Sensory Responsibilities

- Corporate Responsibilities
 - Establishes test methods and procedures for brewery and corporate panels
 - Defines company lexicons for beer, FMB's, Cider, etc.
 - Defines training and validation requirements
 - Establishes Taste Profiles for all brands across product categories



Sensory Responsibilities

- Corporate Responsibilities - continued
 - Determines performance metrics
 - Monitors flavor consistency of brands and breweries
 - Develops test designs and performs statistical data analysis
 - New product and packaging innovations
 - Product, process and packaging improvements
 - Flavor stability / shelf-life
 - Competitor products
 - Performs audits of brewery sensory program



Sensory Responsibilities

- Brewery Responsibilities
 - Trains and validates brewery tasters
 - Conducts in-process testing
 - Raw / incoming materials
 - Water
 - End of fermentation
 - Aging / maturation
 - Bright beer tanks (BBT's) / package release tanks (PRT's)
 - Investigates and troubleshoots brewery flavor issues



Types of Tasters

- Basic Taster
 - Evaluates in-process samples (raw materials, water, EOF, aging/maturation and BBT's)
 - Go / No go release
- Advanced Taster
 - Evaluates packaged product, consumer/trade concerns
 - Monitors consistency of products at brewery level
 - Uses descriptive analysis



Types of Tasters

- Corporate Taster
 - Establishes taste profiles and monitors consistency of product across sites
 - Evaluates:
 - New product and packaging innovations
 - Product, process and packaging improvements
 - Flavor stability / shelf-life
 - Competitor products
 - Non-conforming dispositions
 - Uses descriptive analysis and a wide array of sensory methods



Standardization of Methods and Procedures

- Why do I need to standardize?
 - Repeatability and reproducibility
- What is important to standardize?
 - Test methods
 - Protocol
 - Glassware
 - Serving procedures
 - Temperature
 - Panelist training



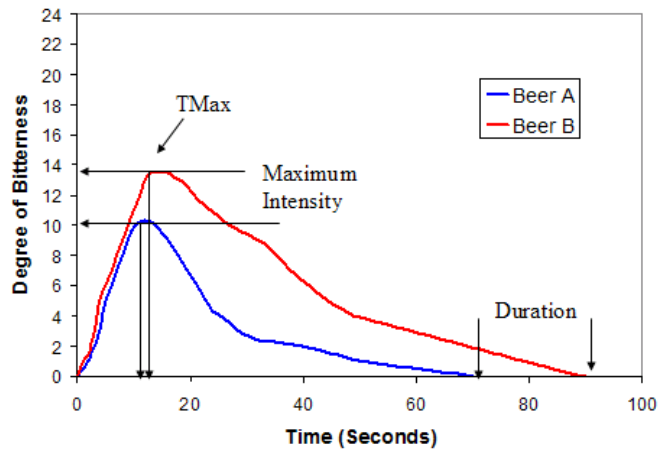
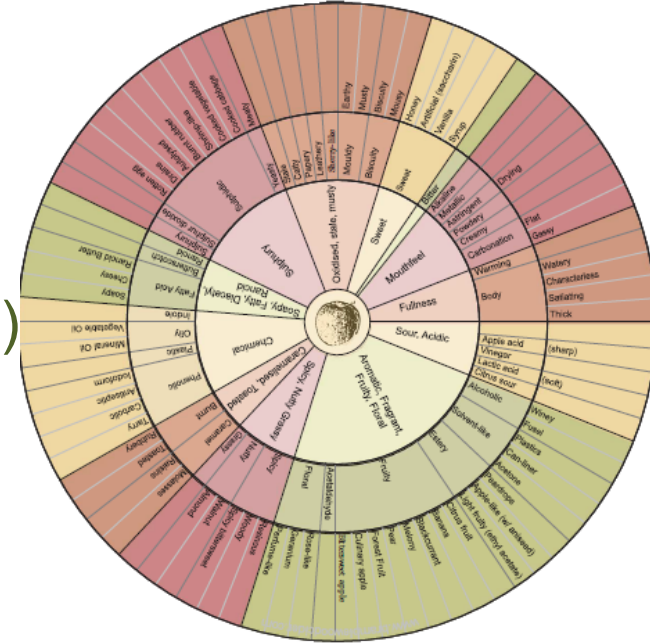
Panelist Training

- Establish minimum training requirements that must be met at all facilities
 - Flavor identification
 - Scaling
- Training requirements are dependent upon type of taster
 - Basic
 - Advanced
 - Corporate






Panelist Training

- Specialized Panels
 - Trained specifically for:
 - Product categories (FMB's, Ciders)
 - Projects (Hop)
 - Methods (Time Intensity)



Panelist Training

- Evaluation techniques must be used consistently among panelists and panels
- Flavor terms and definitions must be used consistently among panels

Icon	Name	Tasting Guidelines	Associated Terms	Notes
	DMS	Swirl the glass to release the aroma. Take short sniffs while holding the beer near the nose.	Sweet Corn Creamed Corn Cooked Vegetable	
	Isoamyl Acetate	Cover the beer with the hand and swirl the glass to release the aroma. Remove your hand and take a single long sniff.	Estery Banana Peardrop	
	Lightstruck	Swirl the glass to release the aroma. Take short sniffs while holding the beer about 30 cm from the nose.	Skunky Sunstruck	

Lexicon for Cider

Cider Lexicon			
		Attribute	Definition
Fruity	Apples & Pears	• Bittersweet apple	<ul style="list-style-type: none"> • “Low”, “heavy”, “thick” fruity note characteristic of traditional cider apples; orchards in the autumn; like the (non-woody) smell under apple trees (“sous bois”). • More red apples
		• Culinary (dessert) apple	<ul style="list-style-type: none"> • Fresh, acidic, “high” fruity note: Granny Smith’s, Cox’s, Bramley apples; green dessert (eating) apple; cooking apple
		• Pear	<ul style="list-style-type: none"> • The aroma associated with cooked and raw pear
	Apples & Pears	• Pectin	<ul style="list-style-type: none"> • The aroma and flavor associated with the skin and flesh of pear
		Tropical Fruits	• Tropical
	Summer Fruits	• Peach/apricot	<ul style="list-style-type: none"> • The aroma associated with cooked and raw peaches and apricots
		• Other Stone Fruit	<ul style="list-style-type: none"> • The aromatics associated with stone fruits including apples, pears, peaches and green grapes
	Berry Fruits	• Berry Fruits	<ul style="list-style-type: none"> • Strawberry; raspberry; blackberry; blackcurrant; gooseberry
	Citrus Fruits	• Citrus Complex	<ul style="list-style-type: none"> • The aromatics associated with the total citrus aromatic impact that includes the raw and cooked notes and the distilled and expressed oil notes
		• Lemon	<ul style="list-style-type: none"> • The aromatics associated with lemon oil, lemon juice and citral
		• Lime	<ul style="list-style-type: none"> • The aromatics associated with the lime oil and lime juice
• Grapefruit		<ul style="list-style-type: none"> • The aromatics associated with grapefruit juice, peel and the whole fruit 	
Citrus Fruits	• Orange	<ul style="list-style-type: none"> • The aromatics associated with orange oil and juice 	
	Preserved Fruit	• Dried Fruit	<ul style="list-style-type: none"> • Raisins; sherry-like; prunes; dried figs; strawberry jam (over cooked) - oxidation
• Cooked Fruit		<ul style="list-style-type: none"> • Cooked apples; cooked pears; stewed apples; stewed pears; apple pies; jam; marmalade 	



Panel Training

- Scaling
 - Establish “Global and Corporate View” of scaling
 - Multiple thresholds of individual flavors

Corporate View on the Scaling Values for Flavors				
Flavor	0.75 X Flavor Threshold	1.5 X Flavor Threshold	3 X Flavor Threshold	4.5 X Flavor Threshold
	Approximate Recognition Level (Scale of 0 – 10)	Approximate Recognition Level (Scale of 0 – 10)	Approximate Recognition Level (Scale of 0 – 10)	Approximate Recognition Level (Scale of 0 – 10)
Acetaldehyde	NA	1	2	3
Acetic	1	1 - 2	2 - 3	5 - 6
Astringent-Coors Light	NA	2	4	6-7 (6.0X)
Bitter	1 higher than control	2-3 higher than control	3-4 higher than control	5 higher than control
Diacetyl	1 - 2	2 - 3	3 - 4	5 - 6
DMS	1 - 2 Above sulphur level	3 - 4 Above sulphur level	5 Above sulphur level	6 - 7 Above sulphur level
Ethyl Acetate	1	2	4	5
Ethyl Butyrate	1 - 2	2 - 3	3 - 4	5 - 6

- Brands representing distinct ranges of attributes on the scale
 - Global brands
 - Company brands

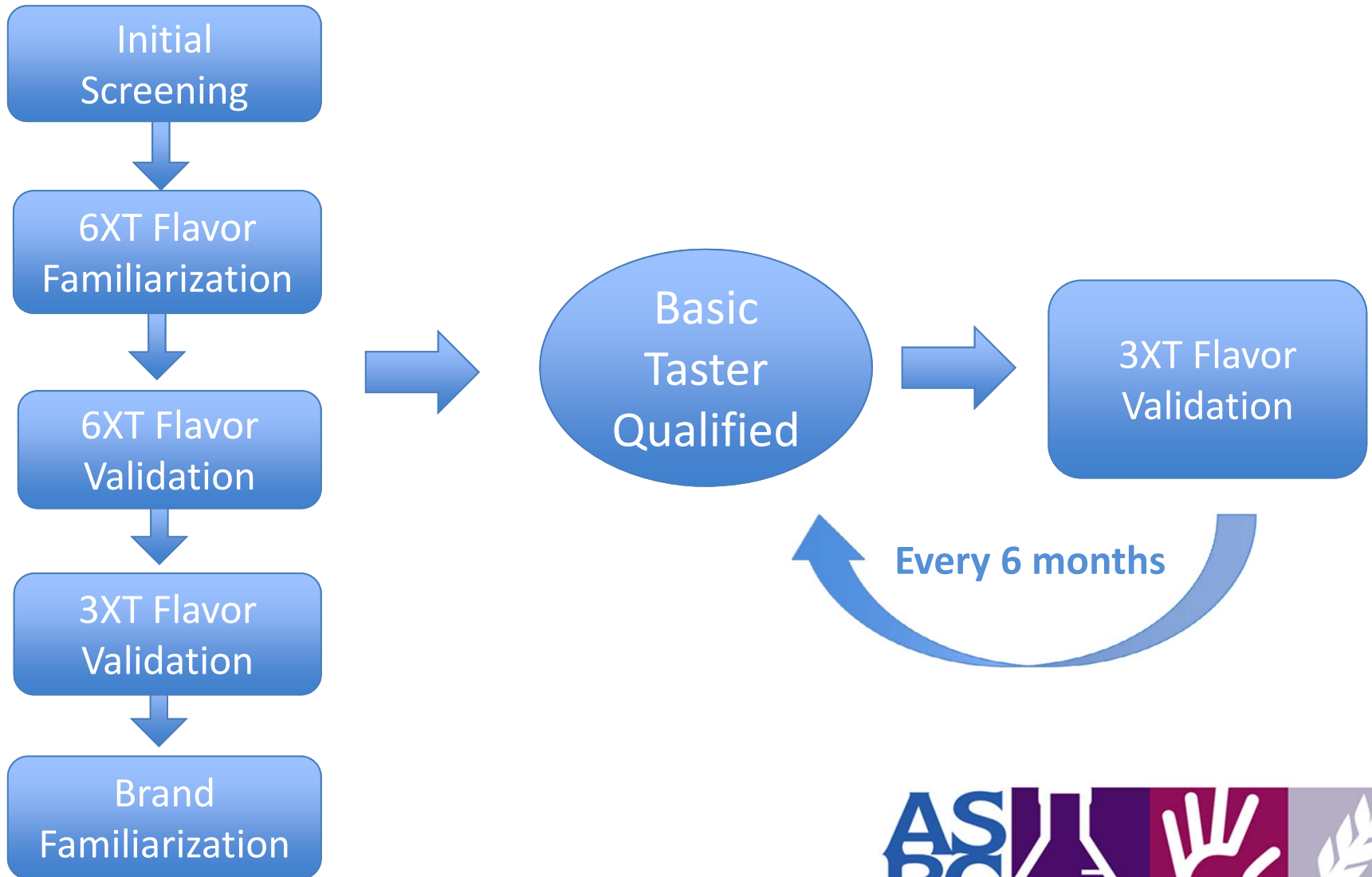


Validation

- Internal Validation
 - Frequency
 - Performance requirements
- External Validation
 - Flavor ActiV and Aroxa provide external validation schemes on Flavor Identification and Rank Rating (Scaling)
 - Establish yearly metrics



Basic Taster Qualification and Validation



Advanced Taster Qualification and Validation



Panel Performance Monitoring

- External Validation
 - Flavor Identification
 - Rank Rating (Scaling)

Taste Panel Performance - TVS Flavor Identification Proficiency (%)								
	Round 41	Round 42	Round 43	Round 44	Round 45	Round 46	N	YTD
	Jan 13	Mar 13	Jun 13	Jul 13	Sep 13	Nov 13	(avg of last 3 rounds)	
Corporate								
Site 1	83	73	83	82	85	78	30	81
Site 2	76	71	78	78	80	68	20	75
<i>Corporate Total</i>	80	72	81	79	84	72	50	77
Brewery								
Site 3	93	78	95	100	94	95	12	92
Site 4	90	77	85	89	88	83	11	85
Site 5	100	100	85	67	100	73	6	90
Site 6	78	70	85	86	77	81	20	80
Site 7	70	69	68	63	75	69	12	69
Site 8	63	57	71	68	77	77	11	68
Site 9	91	85	85	83	79	92	10	86
Site 19	90	83	92	90	89	98	9	90
<i>Brewery Total</i>	83	76	83	81	84	83	90	82

2014 TVS
Performance Targets

≥ 90%
80-90%
70-80%
<70% or N < 10

Green	≥ 75.0%
Yellow	≥ 60.0% and < 75.0%
Red	< 60.0 or N < 10

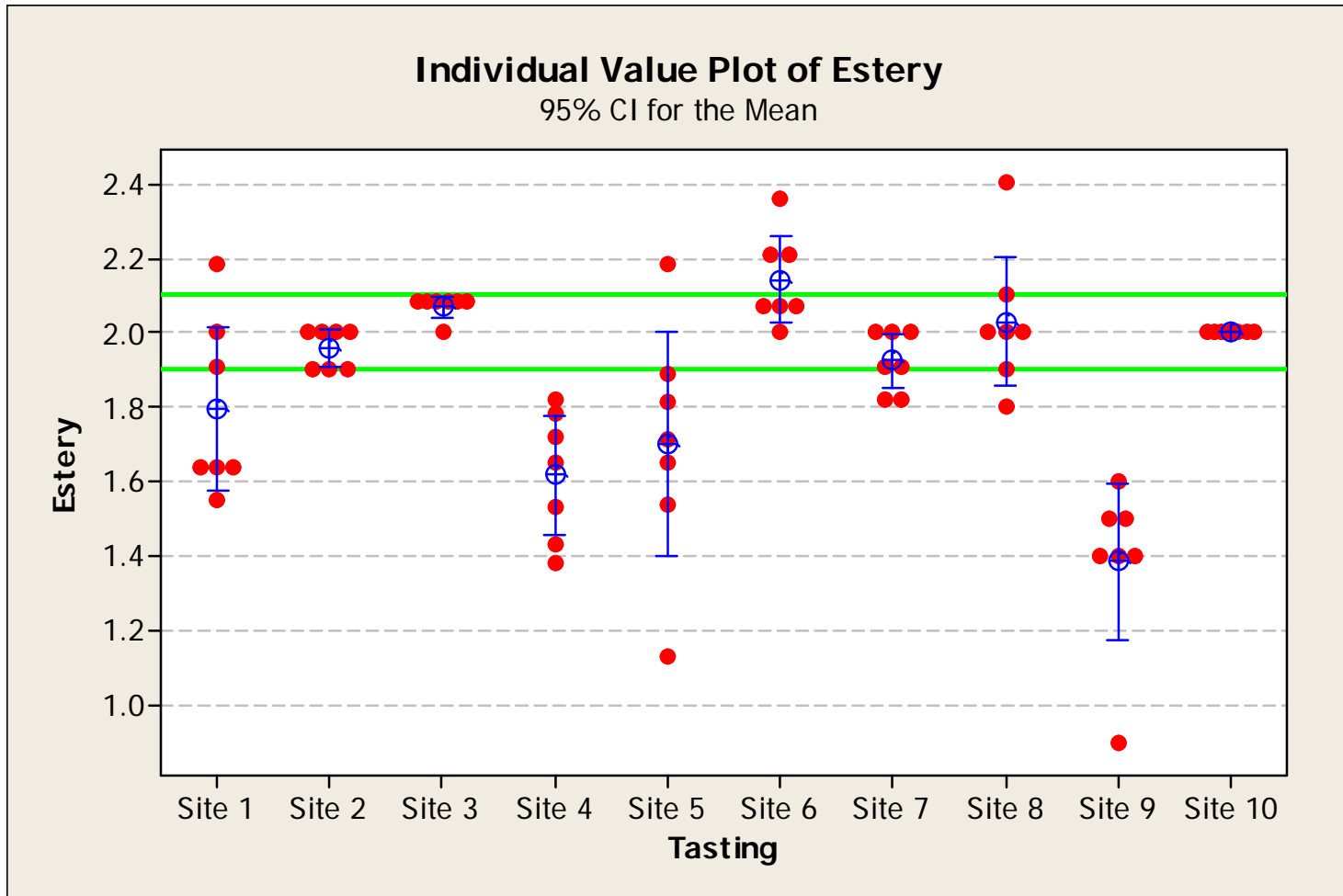


Panel Performance Monitoring

- Inter-facility collaborative
 - Routinely run collaborative testing between facilities to monitor performance
 - Identify scaling opportunities
 - Develop improvement plans for better panel alignment



Inter-Facility Collaborative



Panel Performance Monitoring

- Gage R & R
 - Designed study to determine panel repeatability and reproducibility
 - Evaluated in triplicate across 9 locations

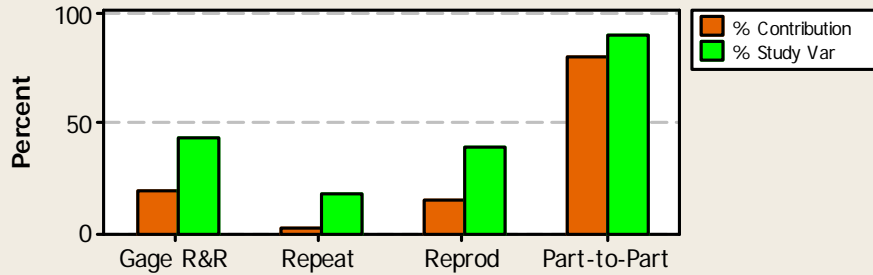
Flavor Added	Sample 1	Sample 2	Sample 3	Sample 4	Sample 5	Sample 6	Sample 7	Sample 8
Isoamyl acetate	1.5 FU	2.5 FU						
Ethyl hexanoate							2.0 FU	
Ethyl butyrate			1.5 FU					
Sucrolose	3 FU	3 FU						
Citric acid					2 FU			
Diacetyl				0.5 FU	1 FU			
Ferrous sulfat			1 FU					
Trans-2-nonenal						1 FU		
H2S							1.5 FU	
Number of flavors	2	2	2	1	2	1	2	0



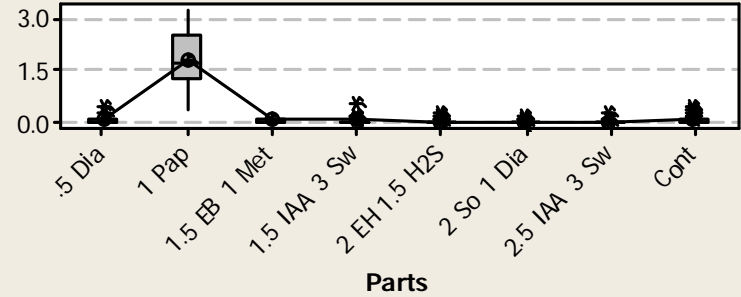
Gage R & R

Gage R&R (ANOVA) for Papery

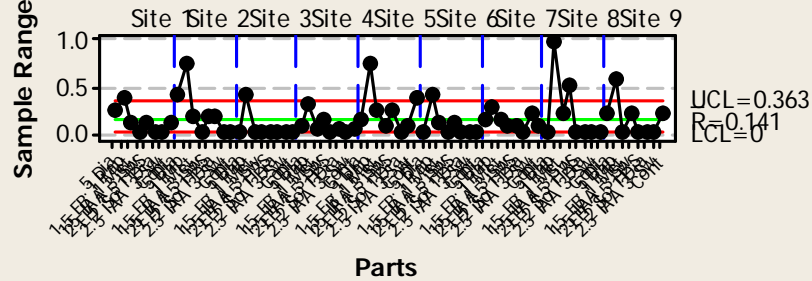
Components of Variation



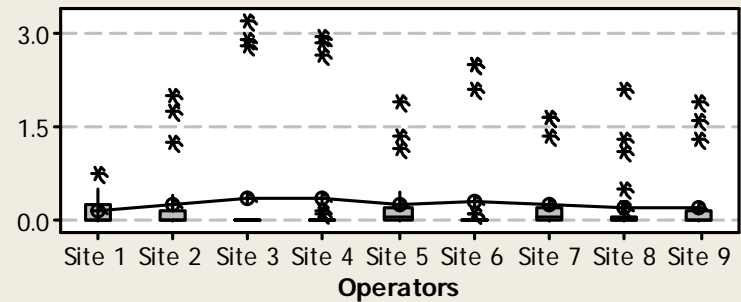
Papery by Parts



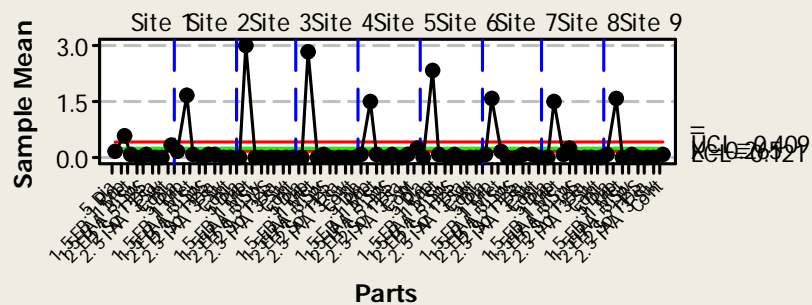
R Chart by Operators



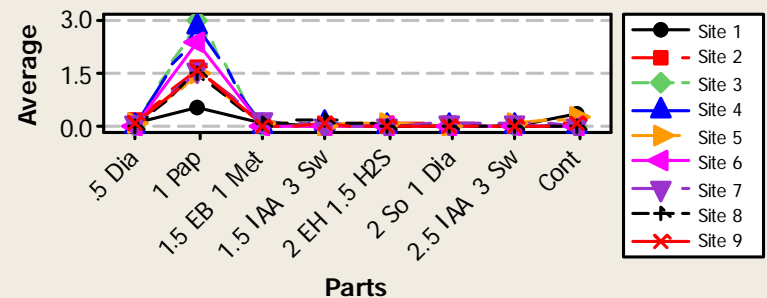
Papery by Operators



Xbar Chart by Operators



Parts * Operators Interaction



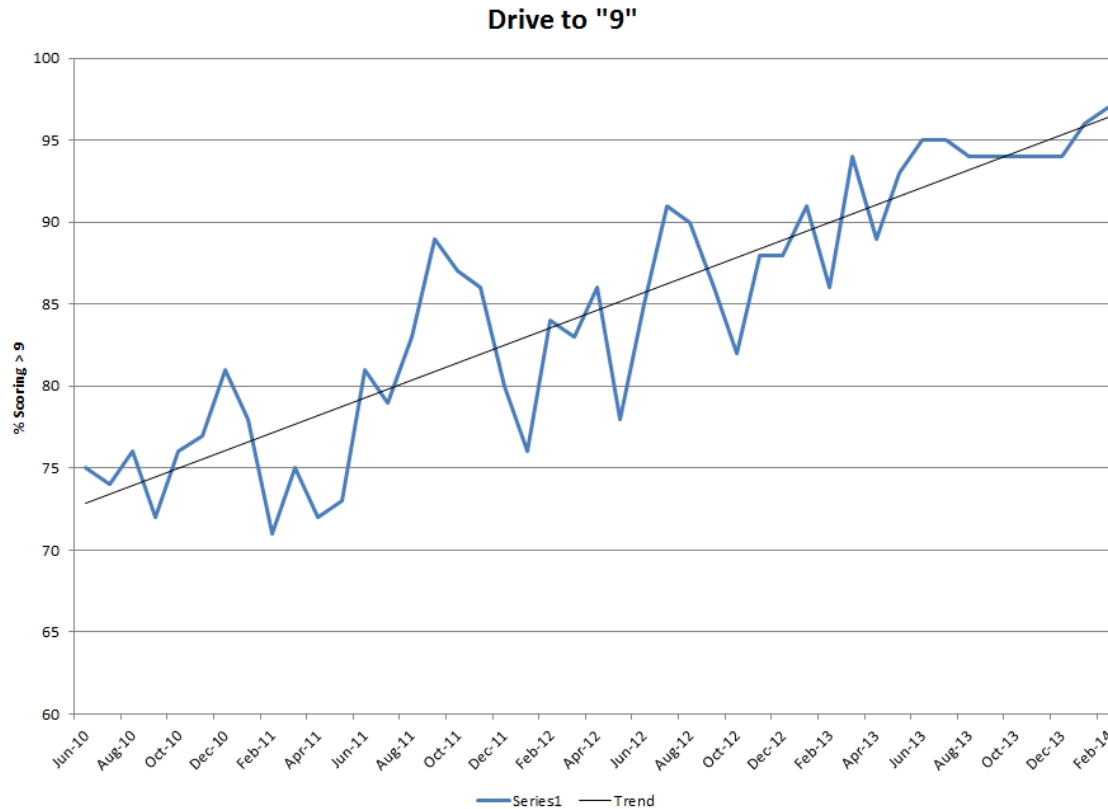
Facility Audits

- Annual audit to assess compliance to established sensory program
 - Sensory practices and procedures
 - Training and validation
 - Methods
 - In-process and packaged product testing program

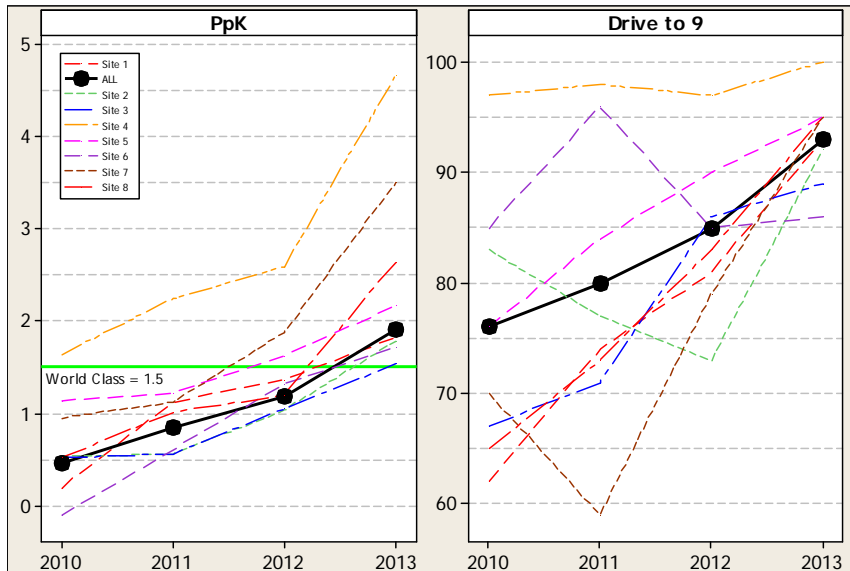
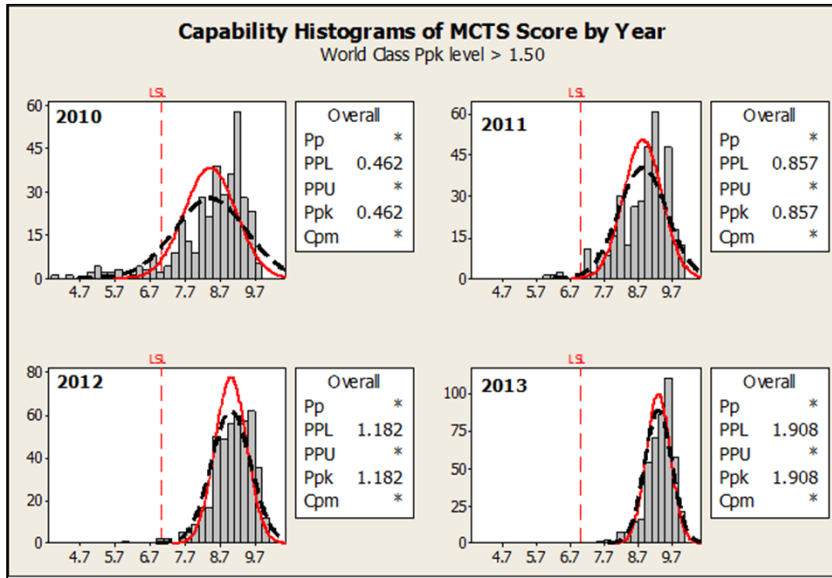


Quality Taste Metric

- Goal - 92% of all Brands scoring > 9.0 (10 point Quality Taste Score)



Taste Variability Metric



- Ppk variability gauge
- Used to tell us how our process (matching flavor profile) is doing compared to specification by estimating the long term variability
- Goal - Ppk > 1.50 (World Class Levels and Six Sigma)



Questions ?

