YAKIMA CHIEF™ -HOPS-

LEVERAGING SENSORY ANALYSIS: BEST PRACTICES FOR CONSISTENCY & INNOVATION IN HOPPY BEERS

JACQUELINE BEARD & TIFFANY PITRA

SENSORY: WHAT IS IT GOOD FOR?

Sensory = Using Your Senses

Not just for pouring beer into tasting glasses and using a scoring sheet!

Sensory is useful in the production space for:

- Listening to equipment to make sure it's functioning correctly (e.g. leak in compressed air, kettle fan operating)
- Identifying where off-flavors are getting into your beer (e.g. anywhere CO2 is off-gassing, like blow-off buckets or bright tank vent arms)
- Judging raw material quality (yeast, water, malt, hops)
- Feeling for temperature changes (e.g. Is glycol working? Have you cleared the hot water fully out of your knock-out line?)
- Sanitation (e.g. mold, microbial biofilms, dirt and dust)

SENSORY: WHAT IS IT GOOD FOR?

But if you're going to pour beer into glasses and use a scoring sheet...

What does your brewery want / need to know about your beer?

Think like a scientist. Have a research question and a hypothesis.

For many of us, the challenge in today's market is to

Make our flagship beers consistent

AND

Refine our innovative, one-off beers for gotta-have-the-newest-thing accounts

SENSORY: WHAT IS IT GOOD FOR?

What does your brewery want / need to know about your beer?

Are you trying to **make a brand consistent and without flaws**?

Do you want to **determine your beer's shelf life**?

Are you trying to **refine a new recipe** and **innovate new flavors**?

Do you want to just **tell drinkers what to expect** when they order this brand in your taproom?

SENSORY TERMINOLOGY

Blind: A sample that is tasted without knowing the identity. Usually labeled with a random number. We taste blind so that known information about the sample doesn't influence our perception.

Double blind: Where the person who set up the analysis also is blind to the sample identities. Allows the person who set up to also taste (this is important if your panel is small or your sensory person is particularly sensitive to the aroma in question).

Lexicon: Vocabulary of a person, language, or branch of knowledge. A shared descriptive terminology.

Panel: A group of tasters who are trained on a shared lexicon.

Spike: An off-flavor compound used to add that flavor to a beer sample. Can also refer to a beer sample which has been spiked (positive control).

Carryover: Influence of a previously evaluated sample on the perception of a subsequent sample

Sensory Fatigue: Becoming desensitized to stimuli due to prolonged exposure

SENSORY FOR INNOVATION

Here are some of the tools we use at Bale Breaker as part of our Sensory Program in order to support the innovation in our Imagination Station (5-bbl pilot brew system):

Descriptive Analysis: *What does this beer look, smell, & taste like?*

Round Table Tasting for Development: *Does this beer taste how we want it to? What do we need to change to bring it in line with what we want?*

Competitive Tastings: *How does our beer taste compared to other beers in the market? What do we like and dislike about our competitors' beers and our own when we taste it blind?*

Fan / Consumer Feedback: *We know that we like this beer, but do our customers like it too?*

SENSORY FOR INNOVATION: DESCRIPTIVE ANALYSIS

Beer: ???

Visual	*Floaties*		*Hazy*		*Clear*
Foam Retention	*Poor*		*Good*		*Persistent*
Overall Aroma Quality	*Bad*	*Sketchy*	*Neutral*	*Good*	*Great*
Overall Aroma Intensity	*Faint*		*Moderate*		*Pronounced*
Aromas & Flavors					
Faults in Aroma					
Faults in Flavor					
Flavor Quality	*You Bad*	*Sketchy*	*Neutral*	*Good*	*Great*
Flavor Intensity	*Faint*		*Moderate*		*Pronounced*
Sweet-Dry Balance	*Candy*	*Slightly Sweet*	*Balanced*	*Somewhat Dry*	*Dry as the Desert*
Acidity	*Candy*	*Slightly Sweet*	*Balanced*	*Acidic*	*Pucker Face*
Bitterness Intensity	*Low*		*Moderate*		*Intense*
Body	*Watery*		*Medium*		*Full*
Overall Malt-Hop Balance	*Malt Dominant*		*Balanced*		*Hops Dominant*
Overall Freshness	*Off*		*Stale*		*Fresh*
Other Notes					

Beer: Growler 663 **Please check all descriptors that apply to the sample in your glass.**

AROMA/FLAVOR:

- ____ Citrus
  - ____ Orange / Tangerine
  - ____ Lemon
  - ____ Grapefruit
  - ____ Orange Peel
- ____ Berries
  - ____ Blueberry
  - ____ Blackberry
  - ____ Raspberry
- ____ Stone Fruit
  - ____ Cherry
  - ____ Peach
  - ____ Apricot
- ____ Melon / Cantaloupe
- ____ Apple / Pear
- ____ Tropical Fruit
  - ____ Mango
  - ____ Banana
  - ____ Pineapple
- ____ Woody
  - ____ Pine
  - ____ Cedar
  - ____ Resinous
  - ____ Dank
- ____ Boozy / Hot / Fusel
- ____ Spicy
- ____ Floral
  - ____ Lily
  - ____ Carnation
  - ____ Chamomile
  - ____ Clover
  - ____ Geranium
  - ____ Peony
- ____ Grassy
- ____ Vegetal
  - ____ Onion / Garlic
  - ____ Canned Corn / Canned Beans
- ____ Sweet aromatic
  - ____ Bubblegum
  - ____ Caramel/Toffee
  - ____ Whipped Cream
  - ____ Honey
- ____ Cereal
  - ____ Biscuit
  - ____ Graham Cracker
  - ____ Bread / Toast
  - ____ Hay
  - ____ Grainy
- ____ Complex
- ____ Simple
- ____ Other (please list):

Sensory, 4/10/19 **Time:** **Who's Tasting:**

Beer: Growler 543

Please describe the flavor and aroma character in this beer using the following rubric. If the listed type of aroma is present, mark with a check mark and indicate specific aroma/flavor characters if possible. If applicable, circle one of the answers below to indicate how ripe the fruit character is. In-between answers are not permitted.

____ Citrus

Types: _____

Ripeness: Pith / Zest Underripe Ripe Overripe

____ Melon

Types: _____

Ripeness: Pith / Rind Underripe Ripe Overripe

____ Apple / Pear

Types: _____

Ripeness: Skin Underripe Ripe Overripe

____ Stone fruit (Peach, Apricot)

Types: _____

Ripeness: Skin Underripe Ripe Overripe

____ Pineapple / Tropical Fruit

Types: _____

Ripeness: Skin Underripe Ripe Overripe

____ Floral

Types: _____

____ Herbal

Types: _____

____ Vegetal

Types: _____

____ Grassy

____ Resin / Dank

____ Pine/Cedar

SENSORY FOR INNOVATION: ROUND TABLE TASTING

A free-form group tasting where everyone tastes first then weighs in. Comments are usually popcorn-style with the goal of refining a recipe with diverse perspectives and palates. Totally appropriate to use hedonic measures.

At BBBC, only experienced tasters, so no ballots. Just a moderator and lots of banter.

Some words of advice:

Set ground rules to keep egos in check. We use the step up, step back principle.

Keep the conversation focused around goals for the beer (flavor profile, market segment) and constructive.

Best to include diverse stakeholders to get lots of different palates and perspectives.

Summarize comments and insights at the end of the round table to keep focused on making positive changes.

SENSORY FOR INNOVATION: COMPETITIVE TASTINGS

Focused around a particular brand.

Buy up similar beers (package type, ABV) in a market and taste them blind. Don’t forget to buy your own beer from the market so that you can taste it against other beers that were treated similarly! For bonus points, taste against the same lot of your beer that is cold-stored to see how being in the market impacts your beer.

After tasting, ranking, and discussing, reveal the beer identities and discuss key takeaways.

SENSORY FOR INNOVATION: FAN / CUSTOMER FEEDBACK

Lots of collection methods: in-person over your taproom counter, on social media, formal / informal

What's your goal?

To see how a new beer is received by a particular market segment?

To decide which experimental recipes to bring to a wider audience?

Some feedback methods:

- Survey online or on paper
- Secret tap handle
- Taproom staff tracking sheet (based on customer conversations)

SENSORY FOR INNOVATION: CULTURALLY-APPROPRIATE LEXICONS

One of the best things you can do for your sensory program if you're focused on innovation is to **develop a lexicon that is culturally appropriate for your staff and fans**.

Lexicon is heavily impacted by which foods you eat, predominant smells in your environment, and culture.

Only possible with most expensive DraughtLab option, definitely possible for Excel-based programs.

SENSORY FOR CONSISTENCY:

Our goal is for **our fans to get the beer they expect** every time they crack a can or sip a pint of our beers in larger distribution. That beer should be **free from faults**, hit the **top aroma and flavor notes**, have the **expected malt / hop balance**, and **age similarly** to other batches.

Here are some of the tools we use at Bale Breaker as part of our Sensory Program in order to ensure the consistency of our core brands:

True to Brand Test: *Does this beer taste like the way we usually describe this brand?*

Data Visualization & Control Charts: *Is this batch of beer really different from the norm?*

Shelf Life Testing: *How does this beer change as it ages?*

Tetrad / Triangle Test: *Did a process change make this beer taste noticeably different from usual?*

SENSORY FOR CONSISTENCY: TRUE TO BRAND TEST

Developed from a descriptive analysis:

Beer: **Growler 663** **Please check all descriptors that apply to the sample in your glass.**

AROMA/FLAVOR:

- ____ Citrus
  - ____ Orange / Tangerine
  - ____ Lemon
  - ____ Grapefruit
  - ____ Orange Peel
- ____ Berries
  - ____ Blueberry
  - ____ Blackberry
  - ____ Raspberry
- ____ Stone Fruit
  - ____ Cherry
  - ____ Peach
  - ____ Apricot
- ____ Melon / Cantaloupe
- ____ Apple / Pear
- ____ Tropical Fruit
  - ____ Mango
  - ____ Banana
  - ____ Pineapple
- ____ Woody
  - ____ Pine
  - ____ Cedar
  - ____ Resinous
  - ____ Dank
- ____ Boozy / Hot / Fusel
- ____ Spicy
- ____ Floral
  - ____ Lily
  - ____ Carnation
  - ____ Chamomile
  - ____ Clover
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  - ____ Peony
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  - ____ Onion / Garlic
  - ____ Canned Corn / Canned Beans
- ____ Sweet aromatic
  - ____ Bubblegum
  - ____ Caramel/Toffee
  - ____ Whipped Cream
  - ____ Honey
- ____ Cereal
  - ____ Biscuit
  - ____ Graham Cracker
  - ____ Bread / Toast
  - ____ Hay
  - ____ Grainy
- ____ Complex
- ____ Simple
- ____ Other (please list):

Example Tasting Sheet:

True to Brand Pass/Fail Analysis

Please read each of the brand descriptions for visual, aroma, flavor, mouthfeel and overall characters and indicate whether the description is accurate for the beer in your glass. If the sample in your glass is not true to brand, please indicate why, referencing specific flaws if possible or, if not, giving as much description as possible about what you taste.

Beer: **Can TC**

Visual: Clear to slight haze with no sediment. Yellow gold with good foam retention and small bubble size.

Does the sample match this visual description?

YES NO If not, why not? _____

Aroma/Flavor: Medium aroma intensity in glass and pronounced retro-nasal flavor intensity. No faults detected. Hops dominate with primary aromas of pine, citrus, and grass. May include earthy, grassy, herbal, stone fruit, tropical fruit, slight onion/garlic, dank, floral, spicy, malt, and boozy aromas.

Does the sample match this aroma description?

YES NO If not, why not? _____

Bitterness: Moderate-high bitterness which is assertive and smooth

Does the sample match this bitterness description?

YES NO If not, why not? _____

Mouthfeel: Medium-bodied but crisp, refreshing and crushable, with balanced dryness.

Does the sample match this mouthfeel description?

YES NO If not, why not? _____

Overall: Is the sample delicious and does it taste like Topcutter?

YES NO If not, why not? _____

Scored as binary (0=pass, 1=fail) or reverse (0=fail, 1=pass)

Data structure is a failure rate or pass rate:

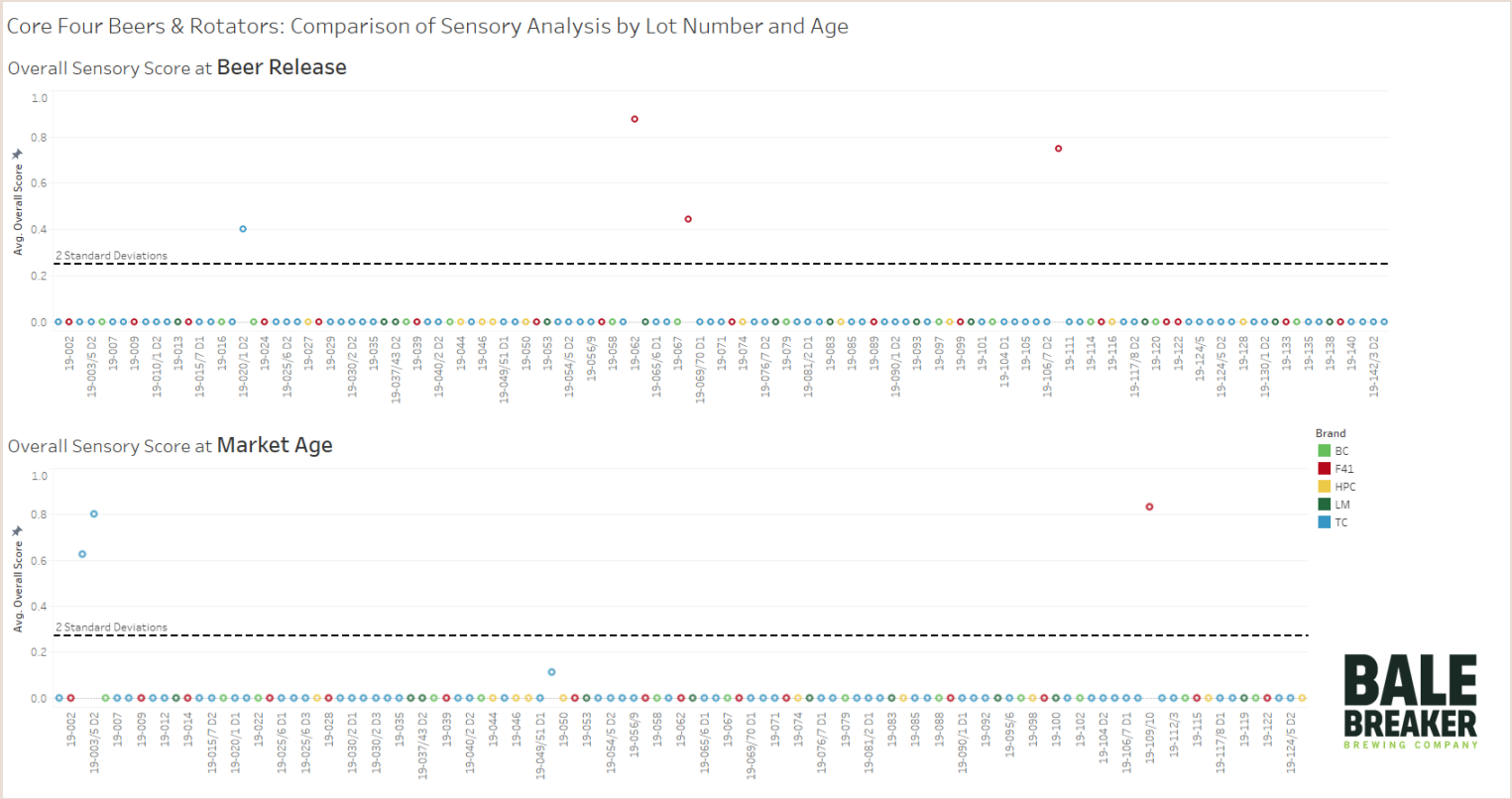
(e.g. 0.50, 0.11, 0.07)

We store this aggregated data in an Excel spreadsheet with the following metrics:

date, # of tasters, sample age, sample brand, sample lot code, and pass/fail info for each category

Then, these data are visualized using control charts in Tableau!

SENSORY FOR CONSISTENCY: CONTROL CHARTS



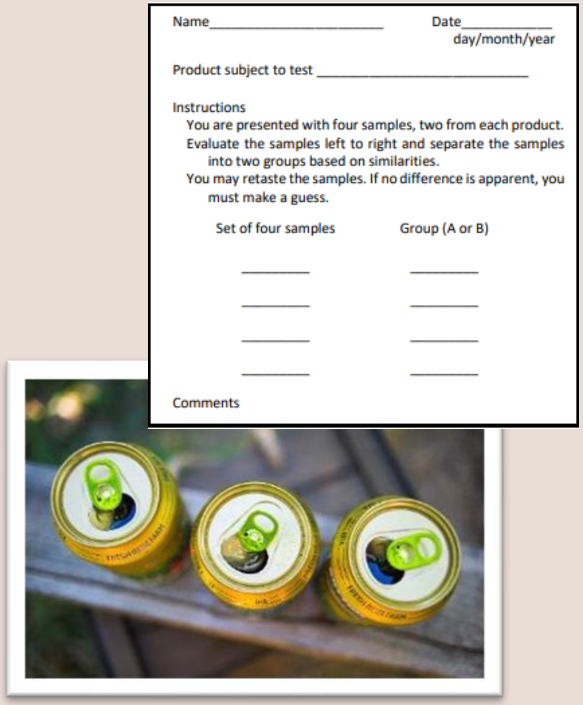
SENSORY FOR CONSISTENCY: TETRAD / TRIANGLE TEST

Triangle test is by far the most overused and abused sensory analysis.

Appropriate to use for a major process change or when the nature of a difference between samples is unknown. You'll waste a lot of time and drive yourself crazy trying to interpret and act on results if you use this for every minor process change or if you have large batch-to-batch variation.

Tetrad Test has greater sensitivity than Triangle Test for smaller panels: ASBC Method Sensory Analysis-18

Use these tests alone or with just a couple of other samples to avoid excessive sensory fatigue.


Name_____ Date_____
day/month/year

Product subject to test _____

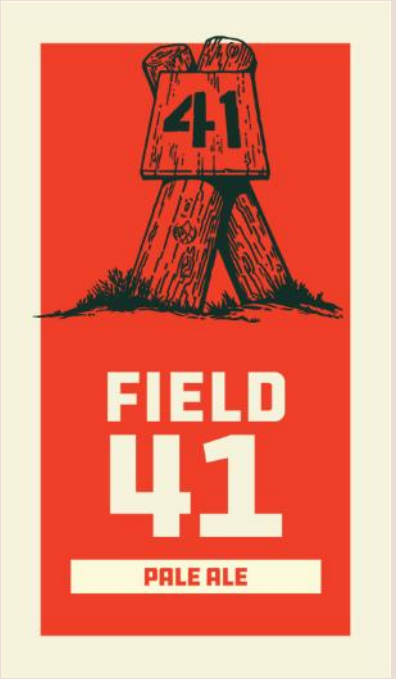
Instructions
You are presented with four samples, two from each product.
Evaluate the samples left to right and separate the samples into two groups based on similarities.
You may retaste the samples. If no difference is apparent, you must make a guess.

Set of four samples	Group (A or B)
_____	_____
_____	_____
_____	_____
_____	_____

Comments

SENSORY FOR CONSISTENCY: SHELF LIFE TESTING

How does this beer change as it ages?



Brand Description:

Clear to slight haze with no sediment.

Yellow color with good foam retention and small bubble size.

Balanced malt and hops. Citrus (grapefruit, mandarin orange), grassy, cereal, wheat. Medium aroma intensity in glass and pronounced retro-nasal flavor intensity with no faults detected.

Solidly present bitterness, moderate to high.

Smooth and crushable, dry, and slightly watery mouthfeel.

SENSORY FOR CONSISTENCY: SHELF LIFE TESTING

GUIDED TASTING

You are presented with three samples:

- Control (stored cold)
- Mildly oxidized (1 wk @ RT)
- Heavily Oxidized (1 wk in a hot car)

Starting with the control, evaluate all three samples

- Is there a visual difference between samples?
- How does the aroma and taste vary between samples?
- How do the samples compare to the brand description?

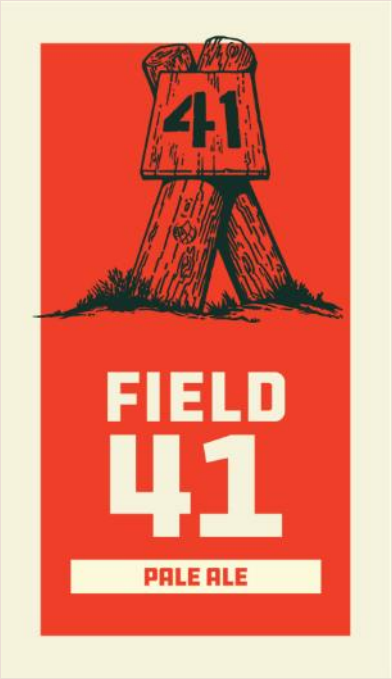
SENSORY FOR CONSISTENCY: SHELF LIFE TESTING

How does this beer change as it ages?

Barnette and Shellhammer, 2019. “Evaluating the Impact of Dissolved Oxygen and Aging on Dry-Hopped Aroma Stability in Beer.”

Decreased tropical, citrus, and hoppy characteristics and expression of malty, dried fruit, and cardboard aromas. Not from hop-derived monoterpenes; could be from lipid oxidation or Strecker aldehyde formation. Aging is a combination of storage temperature and oxygen dosing.

At Bale Breaker, we see decreased fruity hop character and lingering pine / herbal hop character. Increasingly harsh bitterness and increasing malt character, including grainy, cereal, and sweet caramel characters. Can throw significant sediment if thermo-cycled.



SENSORY FOR CONSISTENCY: RAW MATERIALS

(HOPS!)

RAW MATERIALS SENSORY

- Raw hop evaluation
  - ASBC Hop Grind Sensory Evaluation Method (Sensory Analysis-16)
  - ASBC Hop Tea Sensory Method (Sensory Analysis-15)
  - Develop and define sensory specifications
- Preserve quality of samples
  - Storage conditions
  - Usage
  - Retains
- Best practices
  - Maintain records, database
  - Controlled environment
  - Consistency in training and evaluations

Fig. 1. Hop pellets.

Fig. 3. Ground hop pellets (left) and hop cones (right).

Fig. 2. Hop cones.

Fig. 4. Ground hop material in sample jars.

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doi: 10.1094/ASBCMOA-Sensory Analysis-16

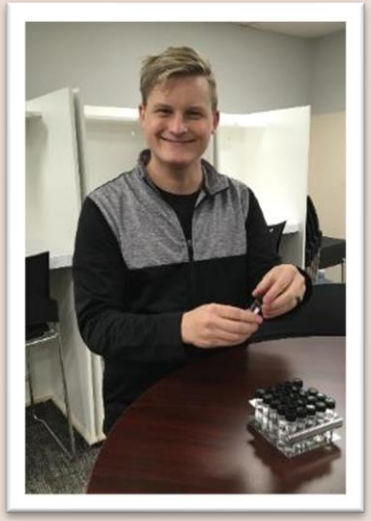
RAW MATERIALS SENSORY: HOP LEXICON

- Industry Tools
  - ASBC Hop Lexicon
  - Draught Lab Flavor Maps
- Product orientation and roundtable discussion
  - Panelists introduced to range of hop varieties
  - Compile list of terms
  - Consolidate like-terms, reduce list
- DEFINE YOUR TERMS!
  - Term- Definition- Reference Standard

RAW MATERIALS SENSORY: REFERENCE STANDARDS

- Train panelists using reference standards
  - Create your own standards set (Sigma Aldrich, grocery store)
  - Purchase pre-made standards (Aroxa, Flavor Active, Siebel)

- Examples of Yakima Chief Sensory Reference Standards
  - Pine: *pine sap, pine needles, pine wood*
    Pine standard: α-Pinene
  - Green Grass: *fresh cut grass*
    Green Grass standard: cis-3-Hexen-1-ol
  - Coconut: *coconut meat, toasted coconut*
    Coconut standard: γ-Nonanoic lactone



RAW MATERIALS SENSORY: “OFF” AROMAS IN HOPS

Common “OFF” Aromas

- *Burnt Rubber*
- *Cheesy/sweaty socks*
- *Moldy/Mildew*
- *Onion/Garlic*
- *Sweaty* (body odor)
- *Vegetal*

The NOT-SO-“OFF” Aromas

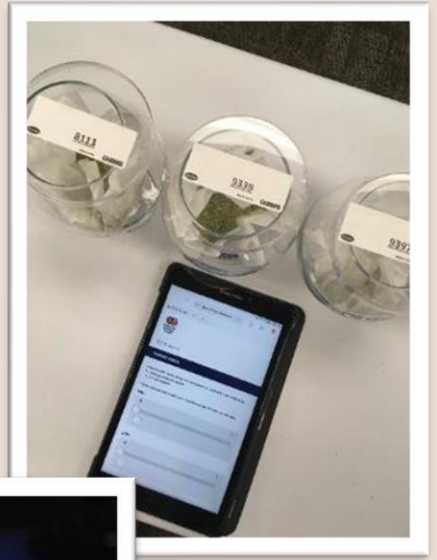
- *Catty*: high concentrations of 4MMP
- What do you mean, *“Dank”* hops?
  - *-Cannabis*
  - *-Resin*
  - *-Onion/Garlic*
  - *-Musty basement*

When discussing off notes, one must consider:

- Variety
- Application
- Brand

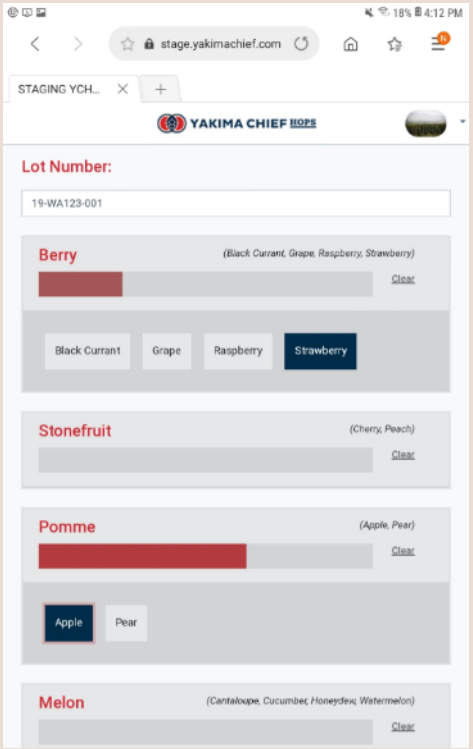
PANELIST TRAINING & VALIDATION

- Availability & Motivation
- Screening for Sensory Acuity
  - General descriptive abilities
  - Identify anosmias and sensitivities
- Panelist Validation
  - Consistency, panelists' repeated measurements on product attributes
- Ongoing roundtable activities & training sessions
- Panelist incentives or competitions

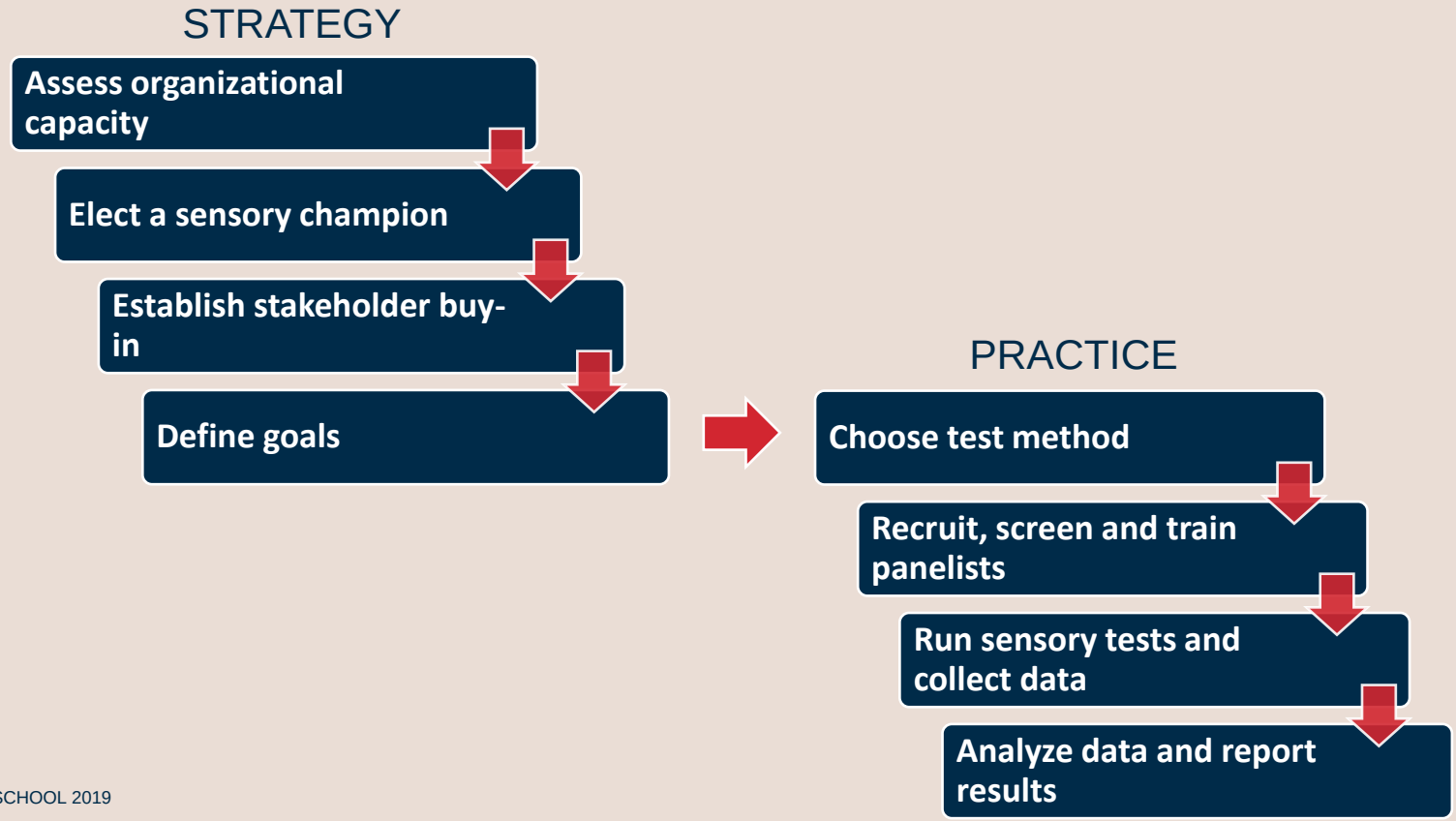


SENSORY BALLOT DESIGN & EVALUATION PROTOCOLS

- Discrimination Test Ballots
  - *Is there a difference between two or more samples?*
  - Blind sample codes, random sample order
- Descriptive Analysis Ballots
  - *What is the description of the sample(s) and how intense are these specific attributes?*
  - No hedonic questions
  - Blind sample codes, monadic sample presentation, random sample order
- Evaluation Protocols
  - Standardize protocol for sample evaluation
  - Incorporate recovery time between samples to reduce carryover effects and fatigue
  - Are panelists trained to complete the sensory ballot(s)?



IMPLEMENTING A SENSORY PROGRAM



SENSORY ANALYSIS FOR *YOUR* BREWERY

- Brand consistency
  - Control charts
  - Difference testing
  - Shelf life testing
- Raw materials evaluation
- Innovation
  - Round table discussion
  - Competitive tastings
  - Fan/customer feedback

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QUESTIONS?

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• AMERICAN HOPS •

FROM THE

PACIFIC NORTHWEST™