HOP & BREW SCHOOL

A LOOK INTO THE WORK OF OUR RESEARCH & DEVELOPMENT TEAM

INNOVATIONS & YCH 301

PRESENTERS

Patrick Jensen, Director of R&D has been with YCH for more than five years. He was born in Yakima, Washington and knew nothing of hops and beer until he graduated from Central Washington University with a B.S. in chemistry in 2004. He owned a Thai restaurant where he was the head chef, but soon after graduation ended up in the hop industry. He has managed several hop quality laboratories since, and now is the research and development director for YCH. He works to develop analytical methods for hop and brewing research, new products and provides technical expertise to our growers, production processes, quality control and sales team. He lives in Yakima, Washington with his wife, daughter and twin autistic sons.

THE YCH R&D TEAM

- **Pat Jensen, Director of R&D**

- **R&D Lab and Agronomy**

  - Jackie Brummett, R&D Lab Supervisor
  - Rob Ring, Formulation Chemist
  - Guadalupe Saldana, R&D Lab Tech
  - Dianeli Gutierrez, Sensory & Lab Tech
  - Lindsay Koby, Field Research Agronomist

- **Sensory & Brewing**

  - Tiffany Pitra, Sensory Manager
  - Tessa Schilaty, Sensory & Brewing Scientist
  - JT Wattenberg, Brewery Manager
  - Dominic Wise, Sensory Tech
  - Tommy Yancone, QC Panel Supervisor and R&D Data Analyst
  - Gustavo Razo, Sensory & Production Research Coordinator







CULTURE OF INNOVATION

- **PEOPLE**
  - Expanded R&D Lab and Sensory teams with experienced hop and beer staff
- **FACILITIES**
  - State-of-the-art R&D lab responsible for creating and refining analytical standards in the hop industry
  - Research brewery conducts continuous product trialing, allowing constant improvement of YCH products
- **CROSS FUNCTIONAL DEVELOPMENT TEAM**
  - Representatives from every department so we can leverage innovative solutions to maximize value for brewers, growers and YCH
  - The supportive and creative environment allows YCH to enrich our entire supply chain through industry-leading hop discoveries

EVOLUTION OF
YCH 301 TRIAL

Traditional Fresh Hops

- Brewers go and pick up hops straight from the farm
- Hops can also be shipped overnight
- Brewer must be prepared to receive the hops and use them once received
  - This is a seasonal product and production of these beers is only done during hop harvest delivered within 36 hours of being picked on the farm

Frozen Fresh Hops

- Flash frozen at after hops are picked
- Frozen fresh hops allow us to store the hops until brewers are ready to receive the frozen fresh hops
  - Brewer can time the delivery to better fit their needs
  - Hops are preserved so brewer is still able to capture the unique profile that a fresh hopped beer provides

- **Application and usage of Fresh Hops and Frozen Fresh Hops**
  - Dosage rate 3 to 6x as whole cones or T90
  - Primarily used in the whirlpool
    - Sometimes after fermentation
    - Utilization is generally poor because lupulin gland is not exposed unless brewer is willing to expose the glands. Break out a food processor and shred them.
  - Very low density- ship a big box with small amount of mass

- **Whole cones vs pellets**
  - Pellets have higher density more mass per box
  - Lupulin gland is ground and exposed so achieve better utilization

- **T-90 pellets vs Cryo Hops®**
  - Concentrated lupulin fraction by 2x (it really is only about 1.8x)
  - Same amount of lupulin in pellet at ½ the mass

NORMAL CRYO HOPS® PROCESS

- Patented process to concentrate hop aromatics
- Liquid nitrogen helps shatter the cones, and displaces oxygen
- Hop remnants are sifted to create 2 fractions
    - Bract-majority leafy material (herbal/grassy/spicy)
    - Lupulin-most of the hops' aromatics (citrus/tropical/woody)
- Powder is then pelletized

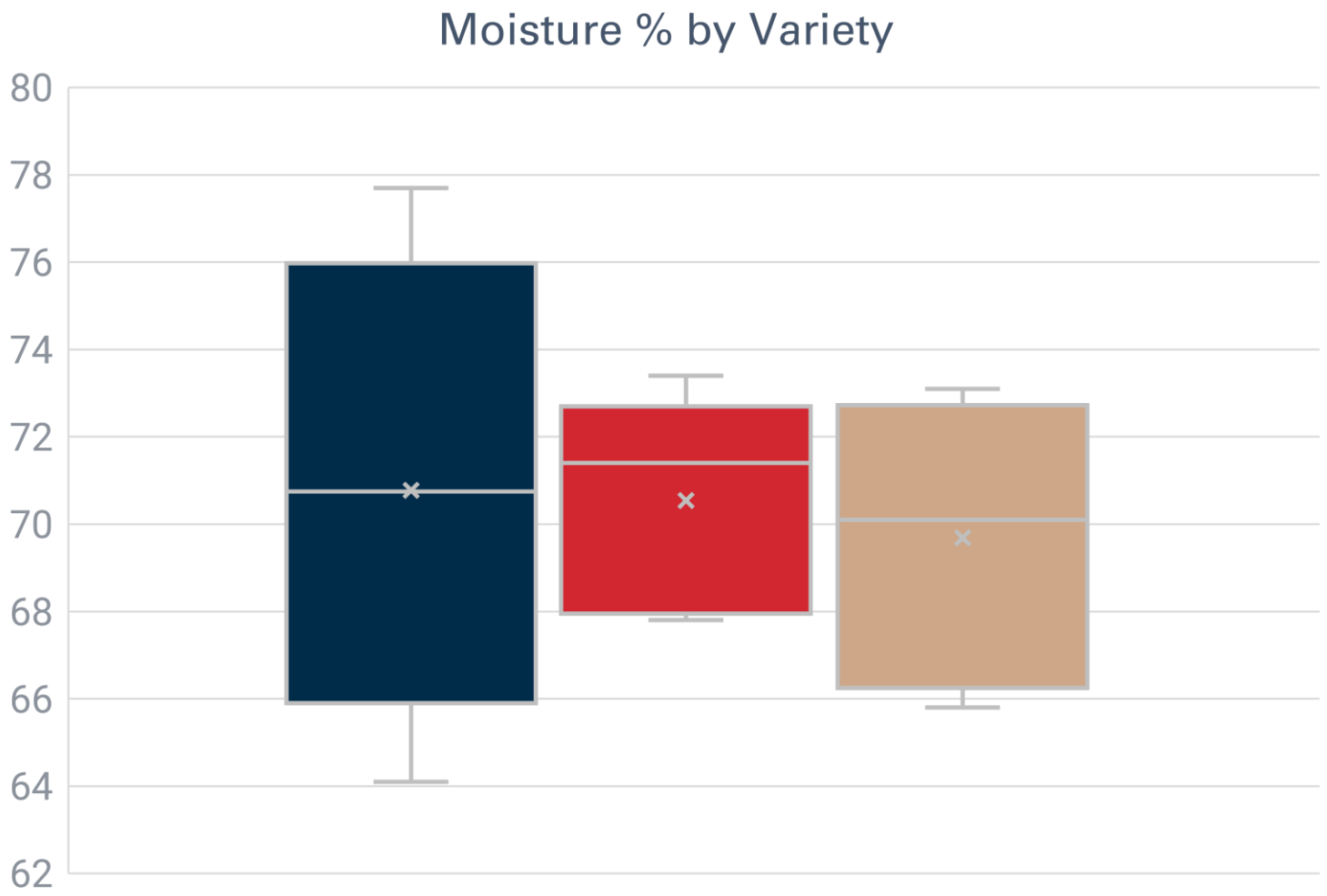
YCH 301 PROCESSING

Field → Freezing → Packaging → Cryo Processing → Pelletizing → Packaging

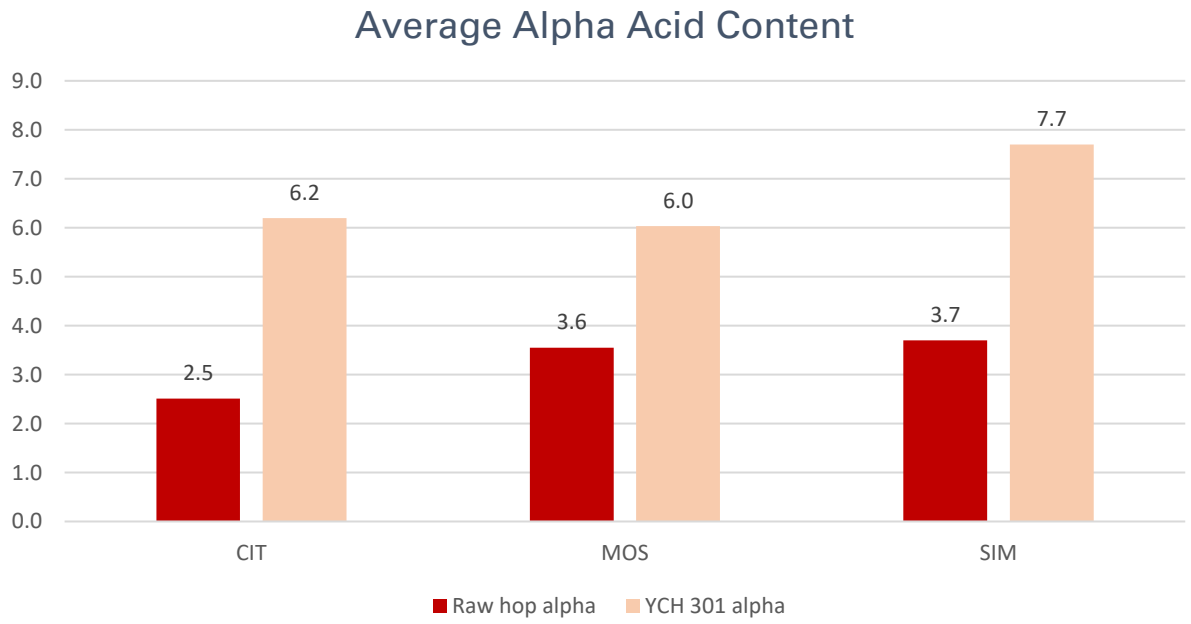
- **2 Part Process**
  - Fresh un-kilned hops are flash frozen
  - The frozen fresh hops are processed using our patented Cryo process to concentrate the lupulin
- **No Kiln Step**
  - Fresh hop character is retained
  - The hops and pellets have to be kept frozen
    - Water content is ~70%
    - Perishable product

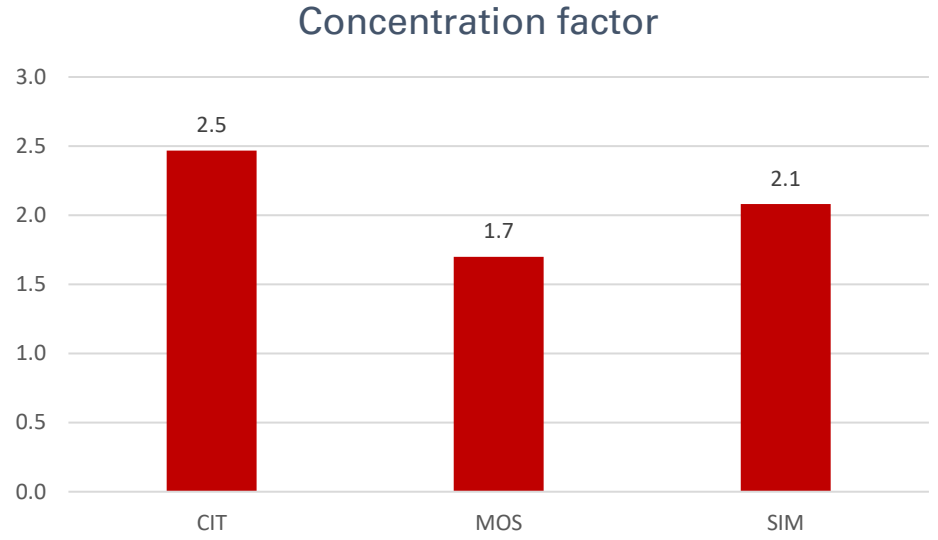
A HIGH MOISTURE PRODUCT HAS ITS OWN DIFFICULTIES

- Entire process keeps the product at frozen temperatures
- Pellets are frozen when they are sealed in mylar bags
- Storage temperature of the final packaged product is -10C to -18C



FROZEN HOPS CONCENTRATED AT THE SAME RATE AS NON FROZEN





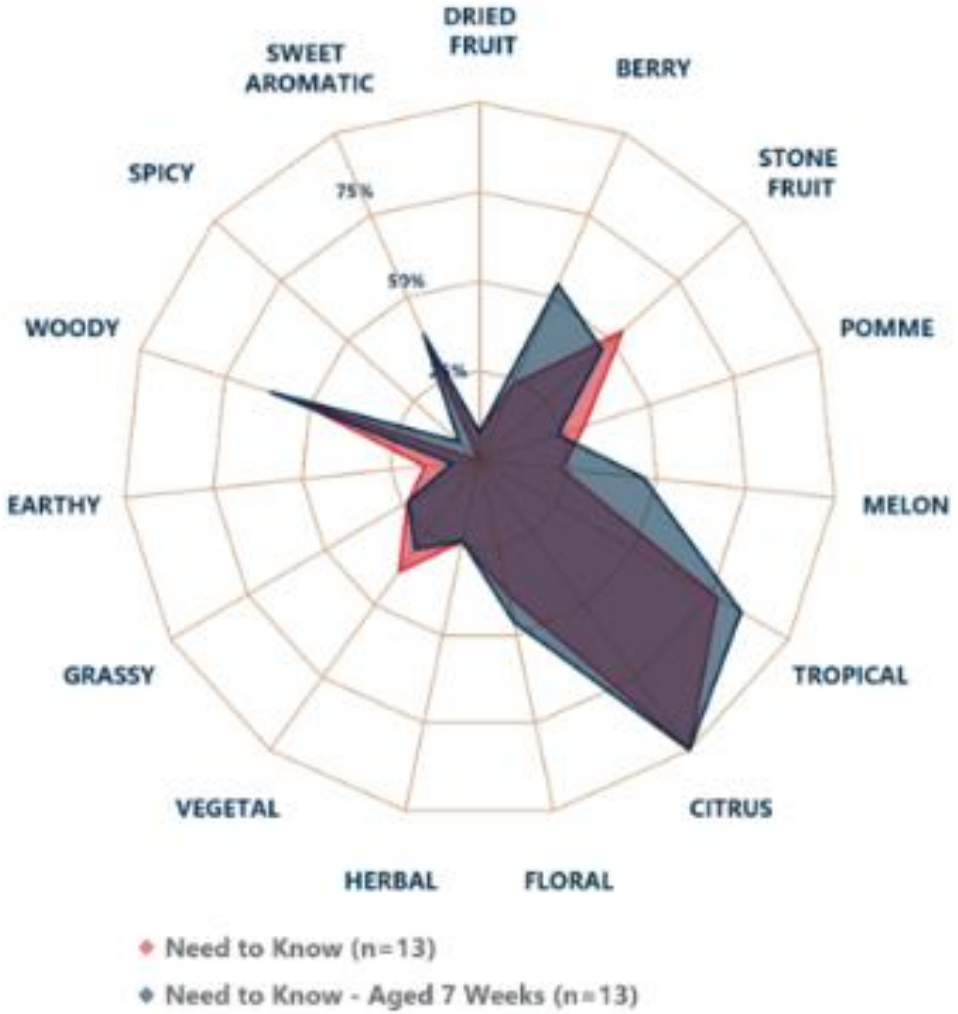
- Concentration factor based on raw hop alpha vs. final pellet alpha is at ~2.2
- Average pellet density is 29.4

YCH 301 TRIAL ANALYTICAL AVERAGE

Variety	Alpha by UV	HSI	Total oil	Moisture
CIT	6.2	0.249	1.3	70.8
MOS	6.0	0.226	1.0	70.5
SIM	7.7	0.233	1.3	69.7

- Low HSI indicator of well the process preserves the lupulin gland
  - Preserving that fresh hop character
- Concentration of final components are about ½ of what a T90 pellet would be
  - Dosage rate would be about 2x than dried kilned hops or T90 pellets
  - Could be used at in all same applications as T90 pellets

SENSORY RESULTS



Attribute	Need to Know
PEACH	46.15%
GRAPEFRUIT	38.46%
LIME	38.46%
PINE	38.46%
APPLE	30.77%
APRICOT	30.77%
LEMON	30.77%
PINEAPPLE	30.77%
GREEN GRASS	23.08%
MANGO	23.08%
BANANA	15.38%
BUBBLEGUM	15.38%
CABBAGE	15.38%
CANTALOUPE	15.38%
CREAMY	15.38%
GUAVA	15.38%
LYCHEE	15.38%
ORANGE	15.38%
PASSION FRUIT	15.38%
TOMATO PLANT	15.38%
VANILLA	15.38%

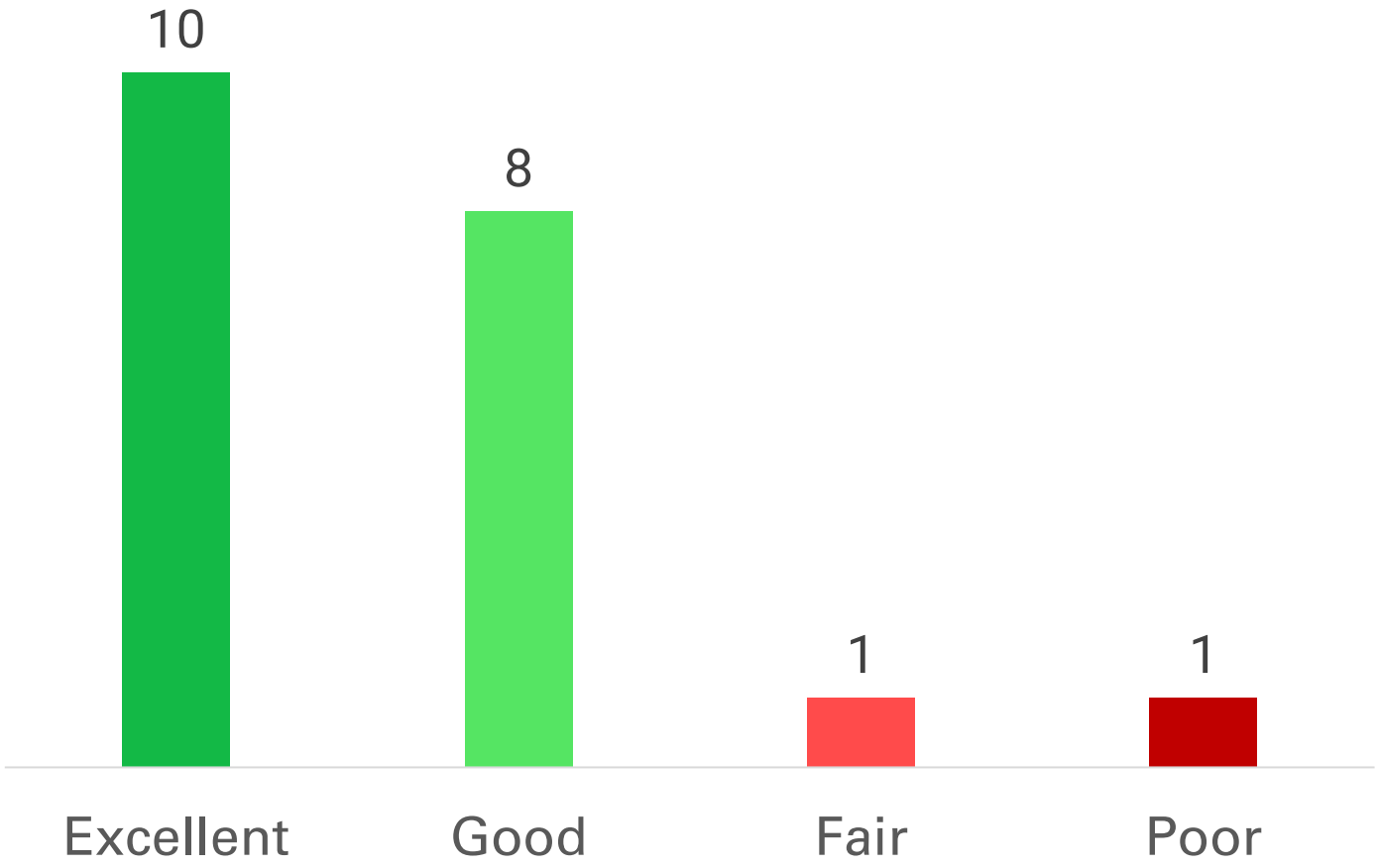
Attribute	Need to Know - Aged 7 Weeks
GRAPEFRUIT	53.85%
MANGO	46.15%
ORANGE	46.15%
LEMON	38.46%
PINE	38.46%
PINEAPPLE	38.46%
APRICOT	30.77%
CANTALOUPE	30.77%
APPLE	23.08%
BLACK CURRANT	23.08%
GERANIUM	23.08%
GUAVA	23.08%
HONEY	23.08%
PASSION FRUIT	23.08%
CEDAR	15.38%
CHERRY BLOSSOM	15.38%
GRAPE	15.38%
GREEN GRASS	15.38%
GREEN PEPPER	15.38%
HONEYDEW	15.38%
PEACH	15.38%
PLUM	15.38%
ROSE	15.38%

BREWER TRIAL

SURVEY RESULTS

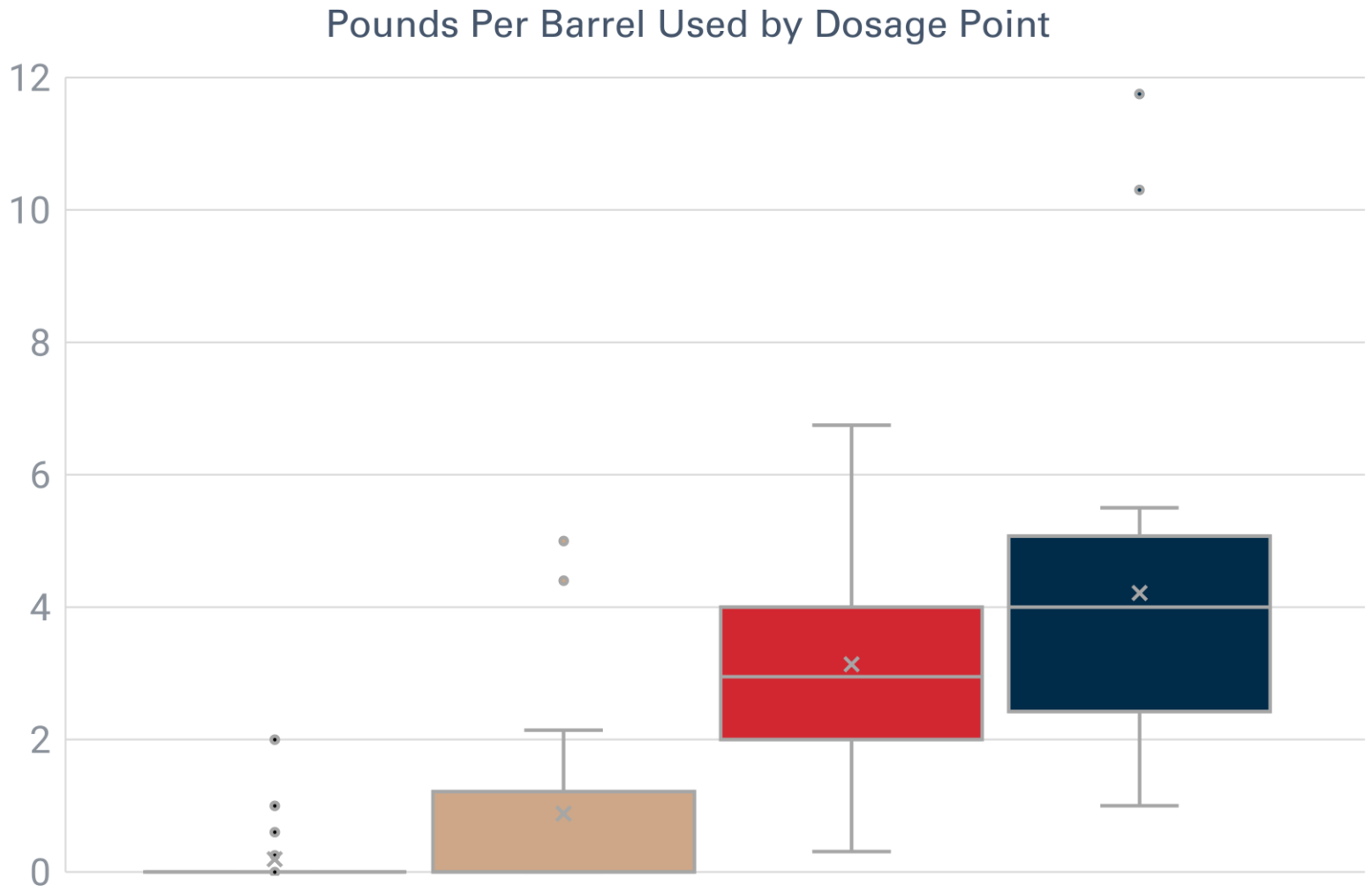
HOW WAS YOUR OVERALL EXPERIENCE WITH YCH 301 TRIAL?

- 20 breweries willing to trial the products survey results.
- All avid users of Fresh Hops and Frozen Fresh hops



BREWERS FOUND IT EASY TO DRY HOP WITH YCH 301

- 2 to 4 lbs per barrel (3 – 12 g/L) seemed to be the ideal dosage rate
- Very similar to T-90 pellets
- YCH Recommended dosage rate 1 to 4lbs per barrel (3 – 12 g/L)



GIVEN THESE USE CASES, WHICH PRODUCT WOULD YOU PREFER?

	Flavor	Ease of Use	Cost	Logistics
YCH 301	**53%**	**94%**	**71%**	**58%**
Frozen Fresh Hops	11%	0%	12%	5%
Fresh Hops	37%	6%	18%	37%

YCH 301 was the most desirable product type for each use perspective.

90%

Said YCH 301 was significantly different than any other Fresh Hop product they've used

- Seasonality of Fresh Hop beers was very important to many PNW brewers
- Source of unique aromatics normally lost in the kiln
- Can be used as a flavour amplifier rather than just for Fresh Hop beers

TRIAL YCH 301 SUMMARY

- **Varieties Available**
  - Citra®, Mosaic® & Simcoe®
- **Packaging**
  - 1x5 kg foils
- **Shipping and Storage**
  - Store between -18^{0}C and -10^{0}C
  - If storage temperature can not be maintained, then use right away
  - You can keep up to 48 hours if storage is -10^{0}C and 2^{0}C
- **How to brew with it**
  - Can be used anywhere in the brewing process but best utilization in whirlpool or dry hopping
  - Dosage rate should be between 3 – 15 grams per litre

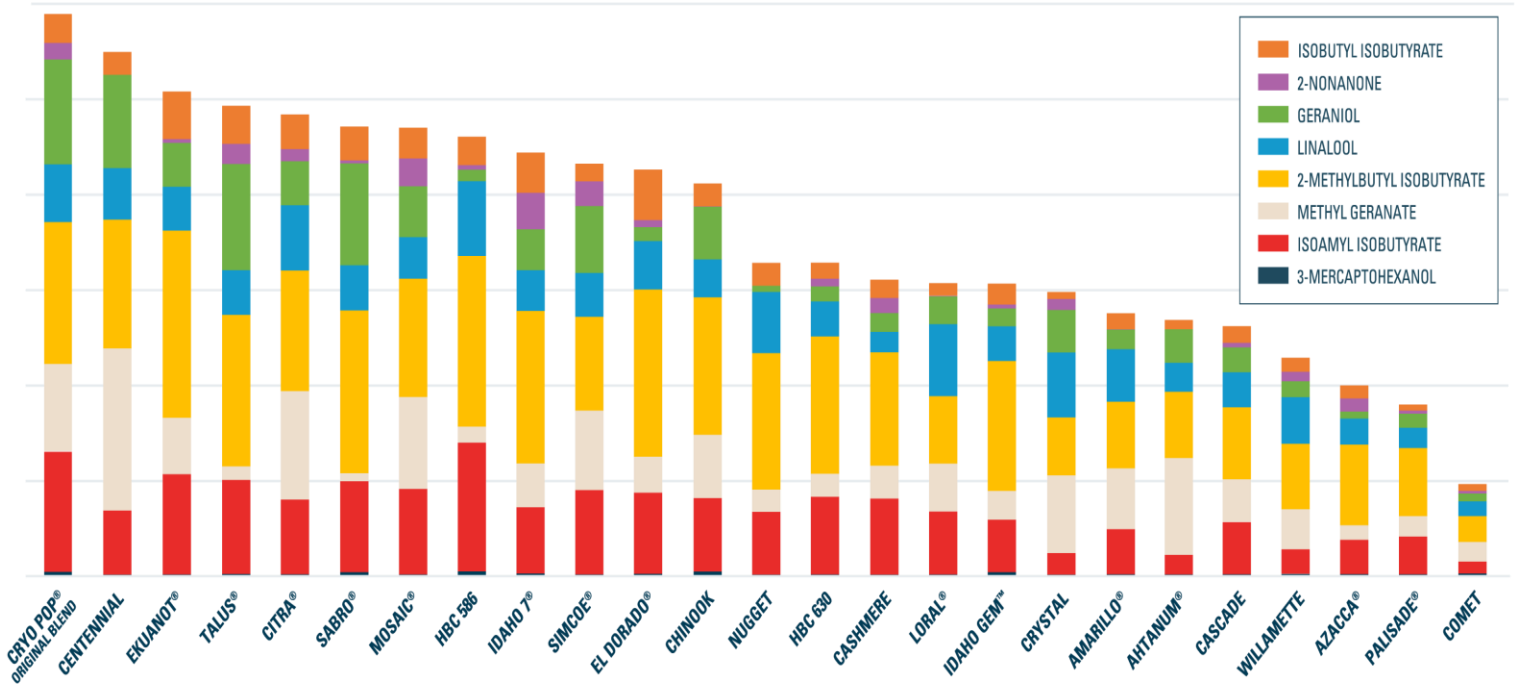
MORE R&D

PROJECTS & INNOVATIONS

CRYO POP® ORIGINAL BLEND

Hops blended to maximise beer soluble compounds

THE SURVIVABLES GRAPH CROP YEAR 2021



- Where we intend to go from here
  - Flavor specific blends
  - Which will target specific flavors.
    - Perhaps a Mango or Berry blend

CRYO HOPS® X PHANTASM

YCH 303 Trial

- Cryo Hops® and Phantasm blended to create one
- co-pelleted product.
- Mosaic®, Citra® and Simcoe® brand hops
- Phantasm – Derived from the sking of New Zealand grown Sauvignon Blanc Grapes.
  - Grapes that are known to bring thiols into wine.

STATUS: Limited first trial sold out.

AROMA EXTRACT PRODUCT

Low temp extraction using food safe solvents

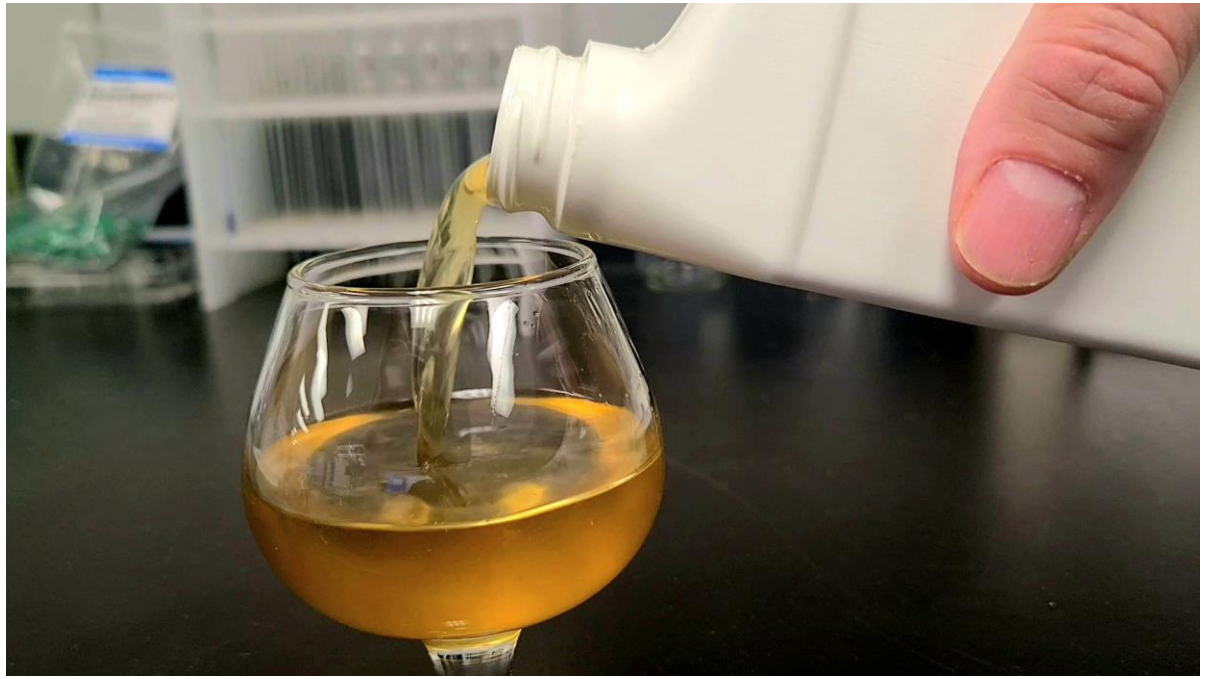
Extremely high in essential oils 60-80%

- Made for aroma additions
  - Tested in whirlpool conditions and has been tested in dry-hop conditions as well
- No vegetal matter

Completely varietal specific

- Dosage rate in whirlpool is 1/50th of a T-90 equivalent
  - 1 kg T-90 is replaced by 20g
- Completely flowable

STATUS: Currently in Trials



QUESTIONS?

YCH R&D General Contact
brewinghelp@yakimachief.com

• AMERICAN HOPS •

FROM THE

PACIFIC NORTHWEST™