

Hops in the Brewhouse: Experiencing Varietal Variation

Zach Turner

Director of Quality and Sustainability at Hopunion

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Part 1 – Brewing is Agricultural

- **Varietal Variation**
- **Factors influencing character and quality**

Part 2 – What Kind of Story do you want to tell?

- **Hops as a commodity or a specialty**
- **Hop options in the Brewhouse**

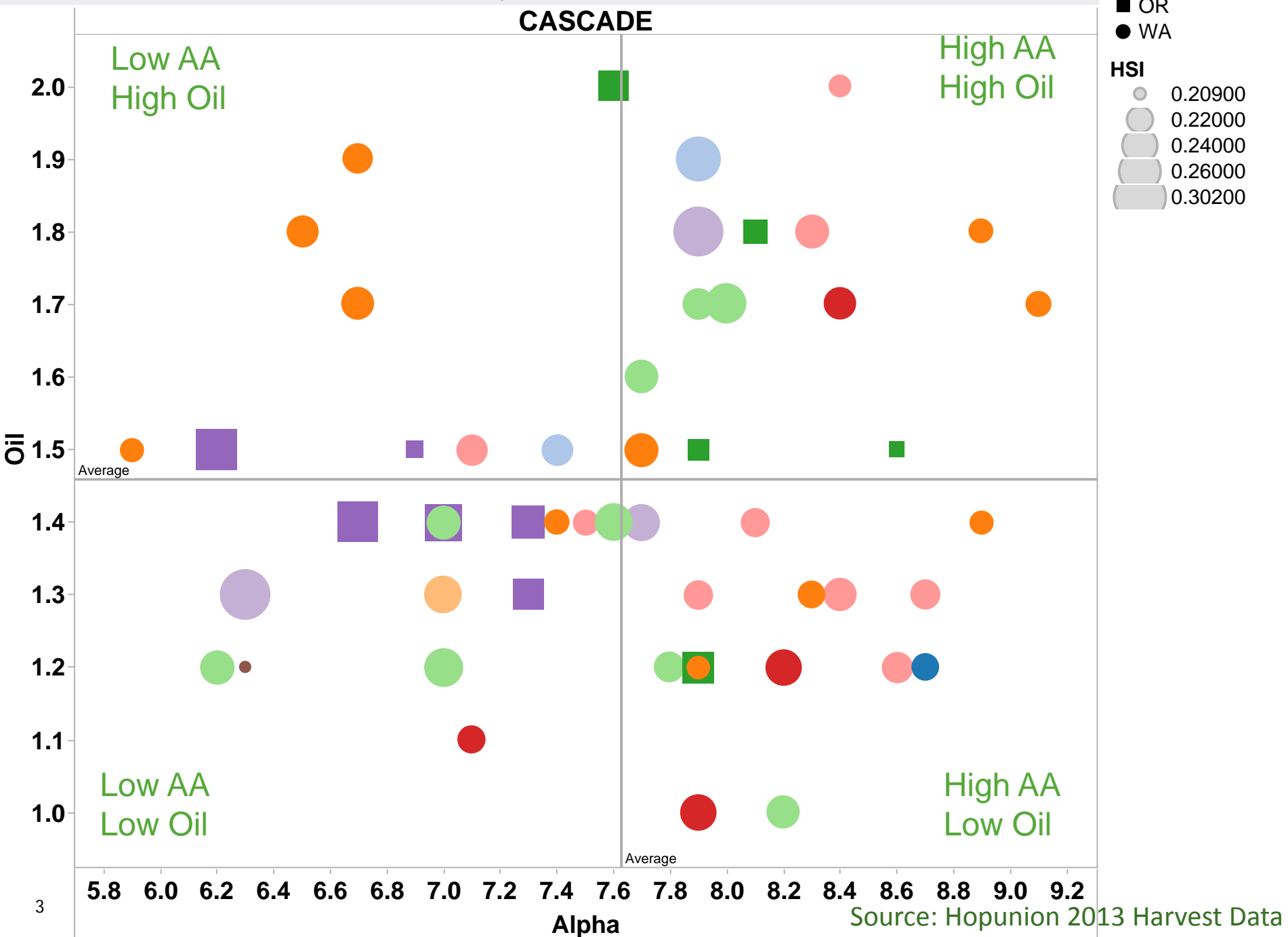
Part 3 – Post Boil Hopping

- **Who needs bittering additions?**
- **Hopbacks**



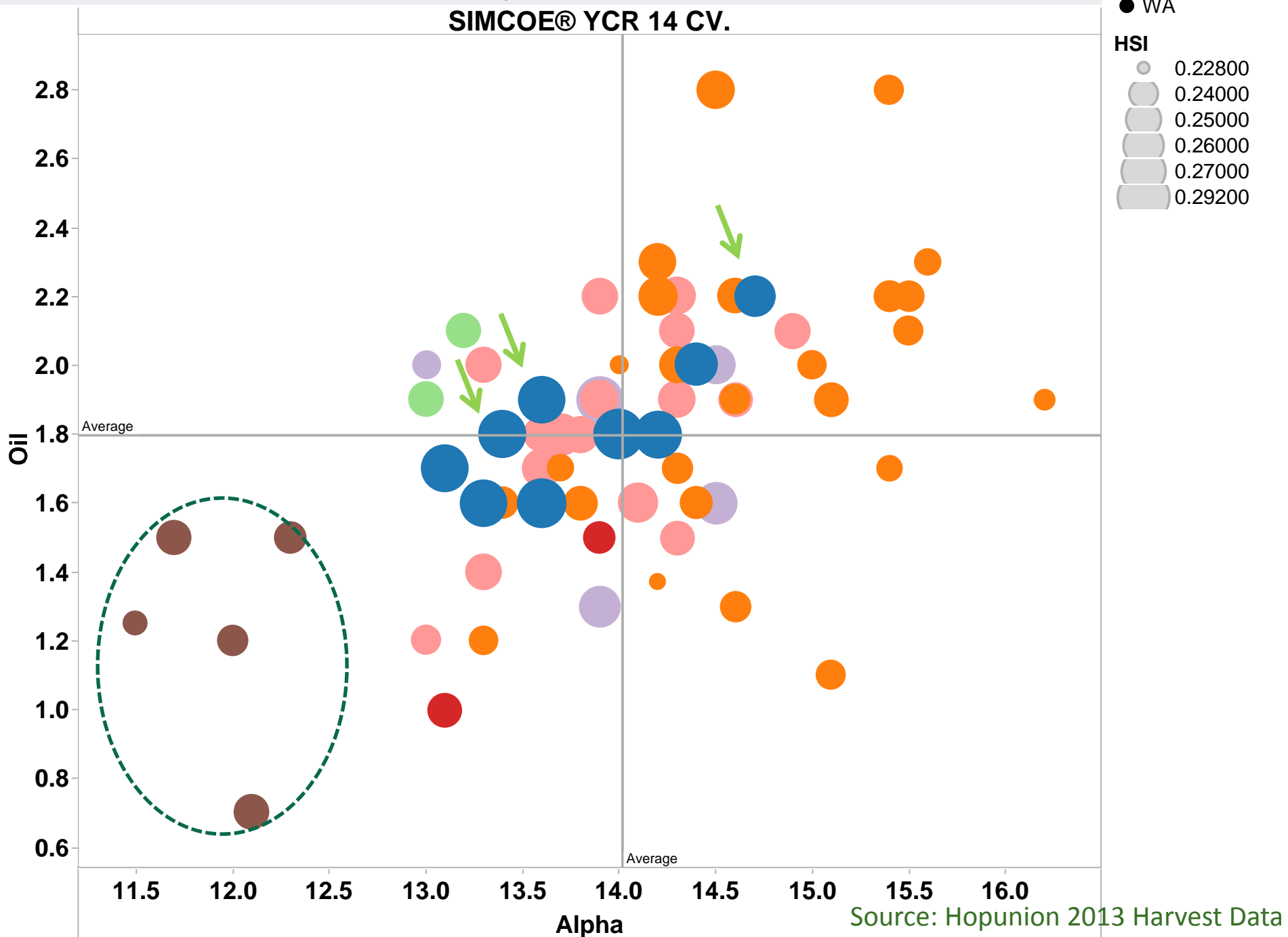
Alpha vs Oil

CASCADE



Alpha vs Oil

SIMCOE® YCR 14 CV.



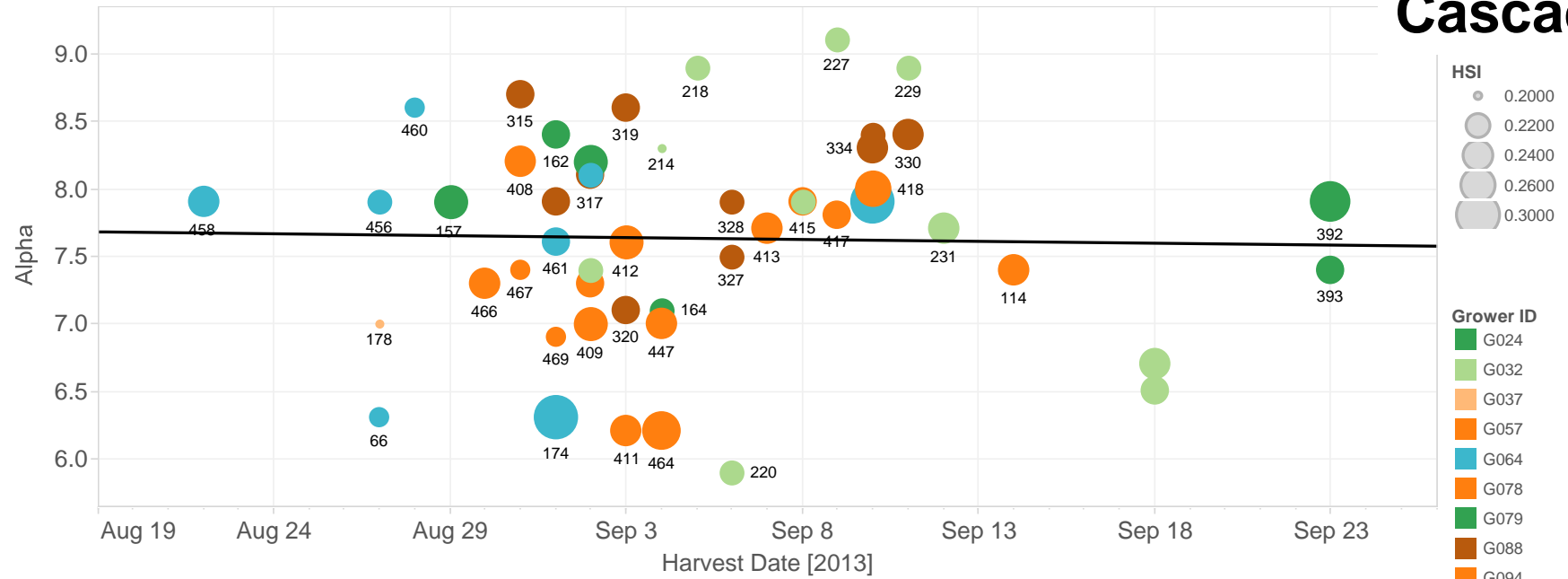
Factors

- **Regional/Abiotic – latitude, climate, soil structure**
- **Root Stock Age, Health and Purity – think yeast management**
- **Cultural Practices**
 - Burnback, training, vines/acre, cover cropping
- **Harvest Timing**
- **Harvest Handling**
 - Pickers, kilns, farm cold storage, processors, cold storage

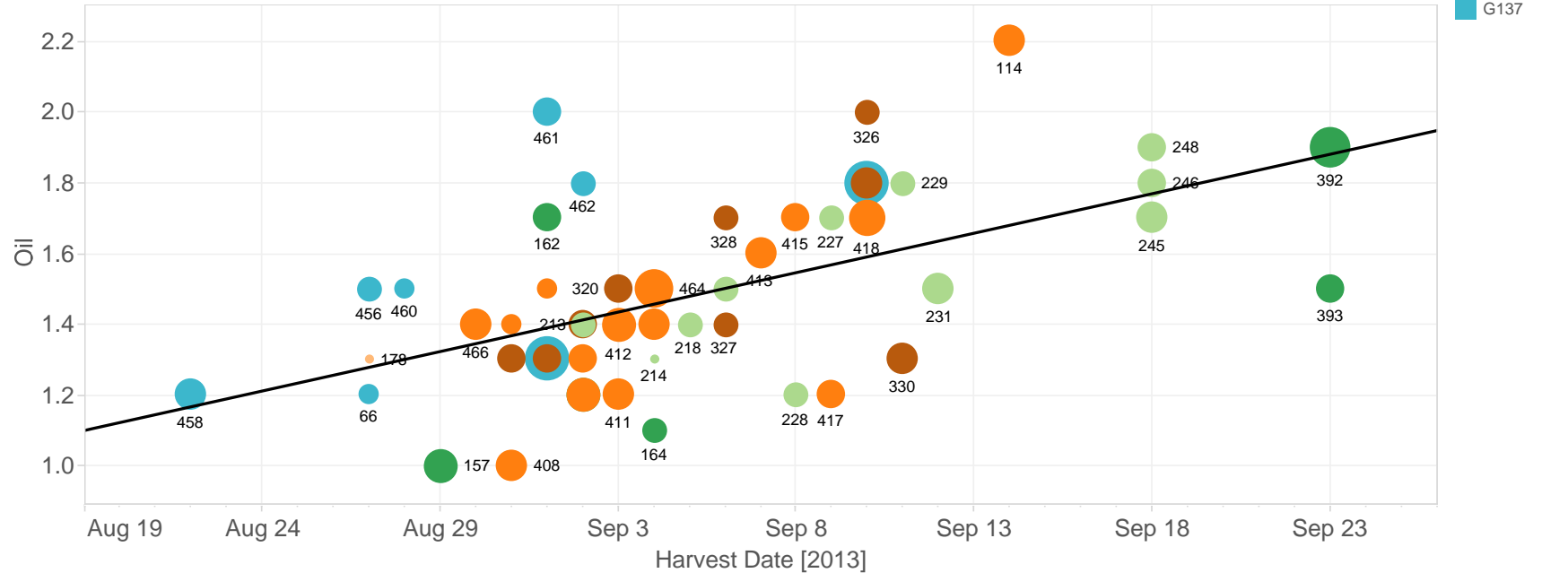


Cascade

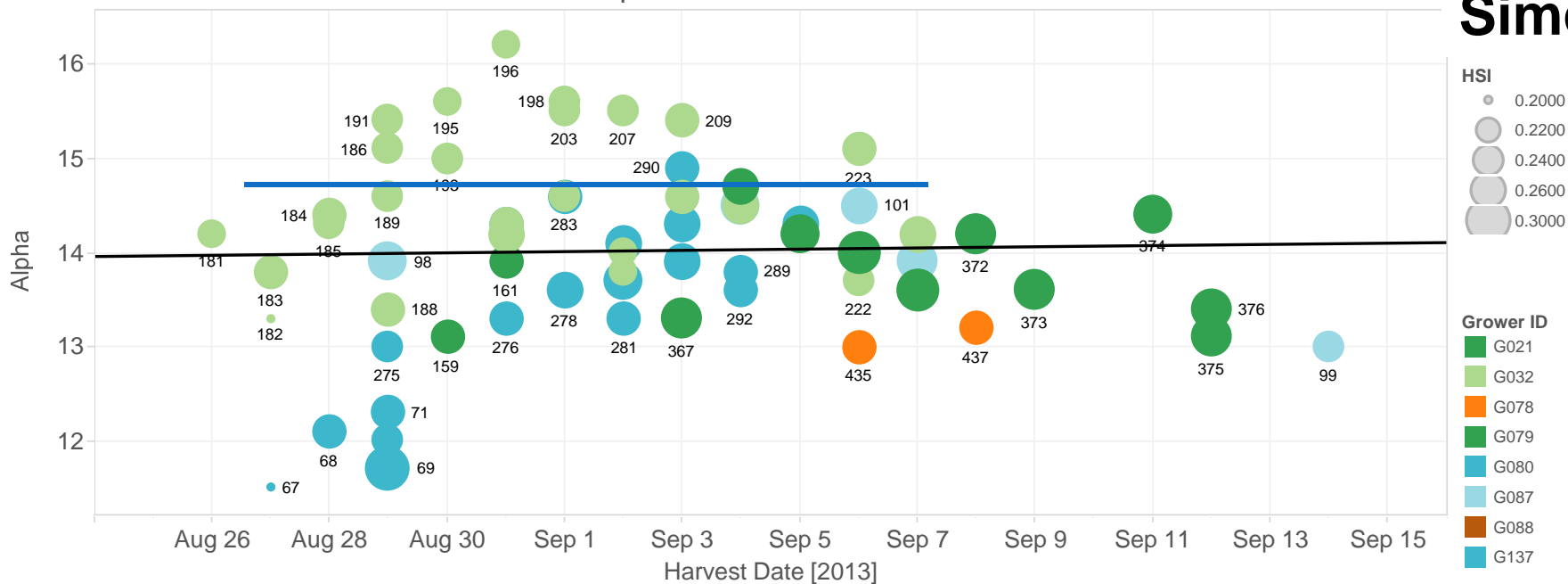
Alpha vs. Harvest Date



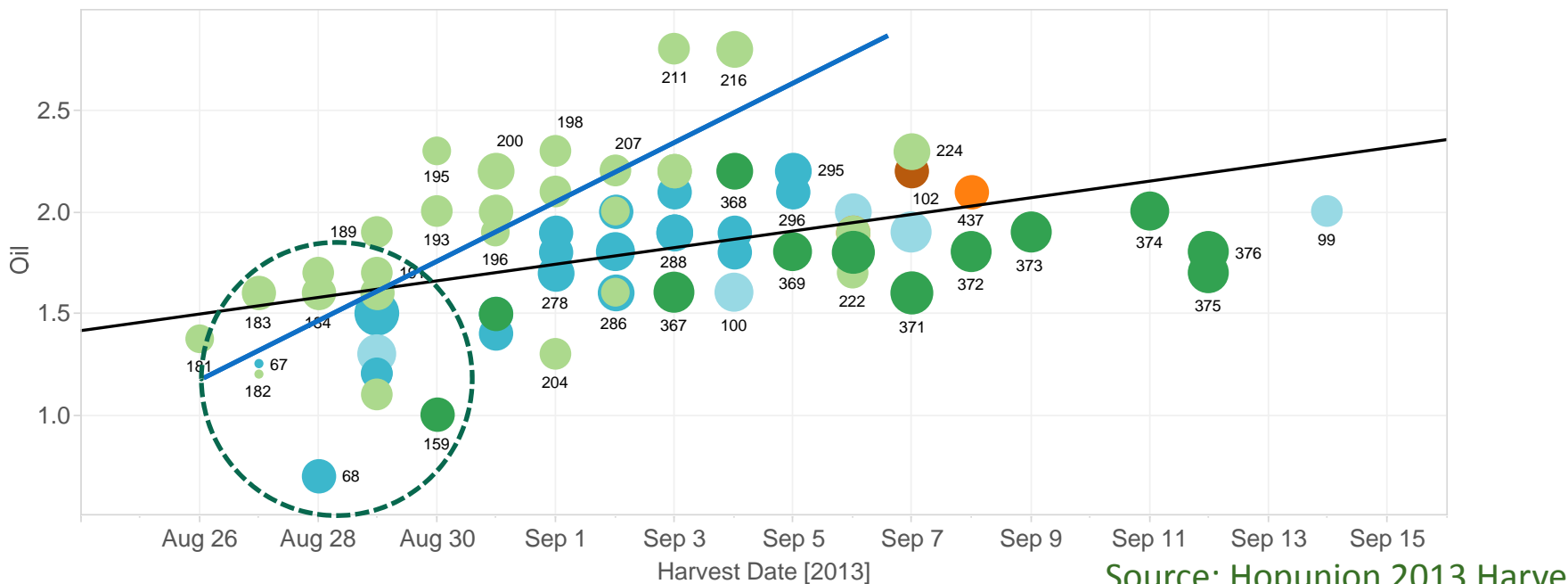
Oil vs. Harvest Date



Alpha vs. Harvest Date

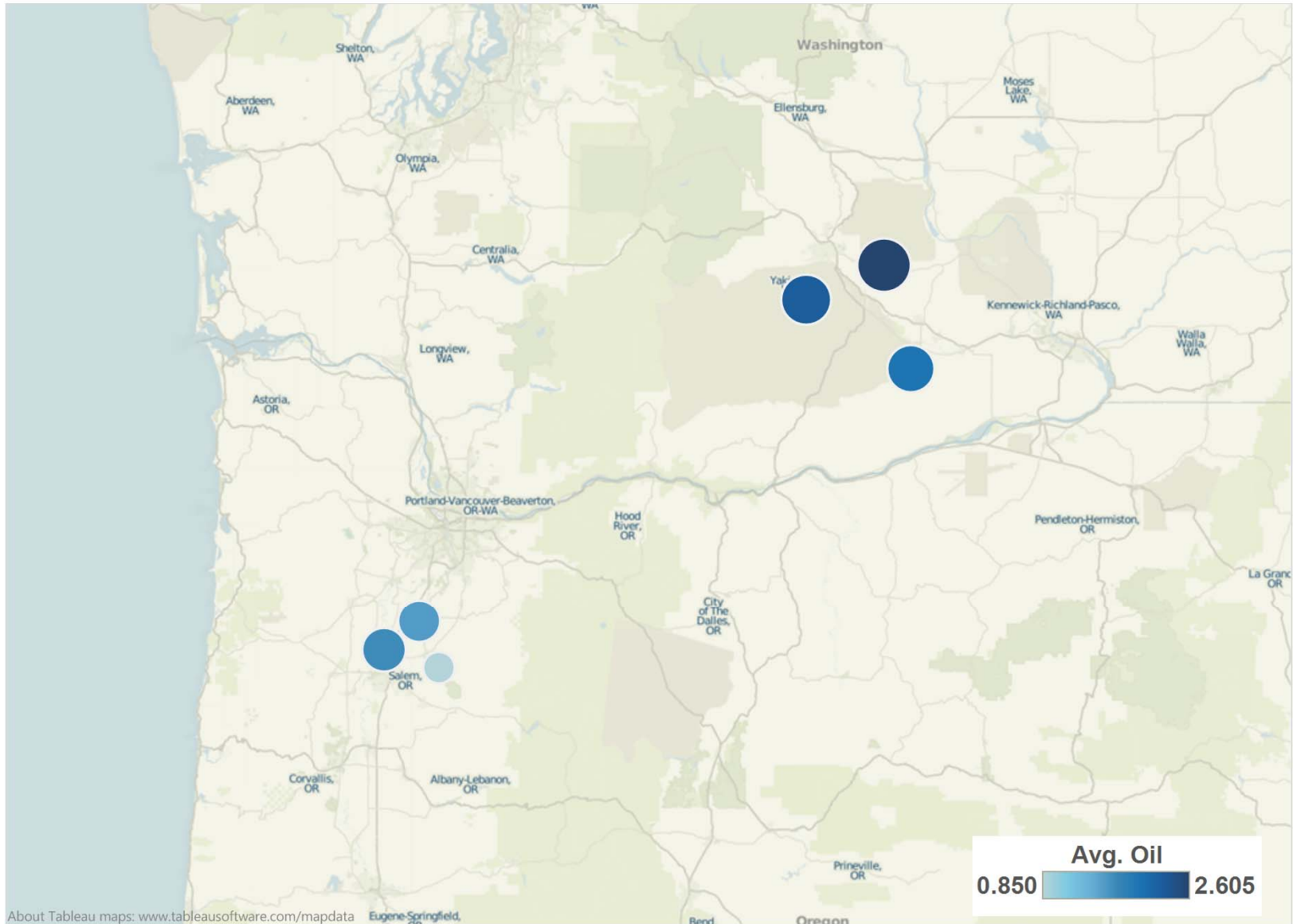


Oil vs. Harvest Date



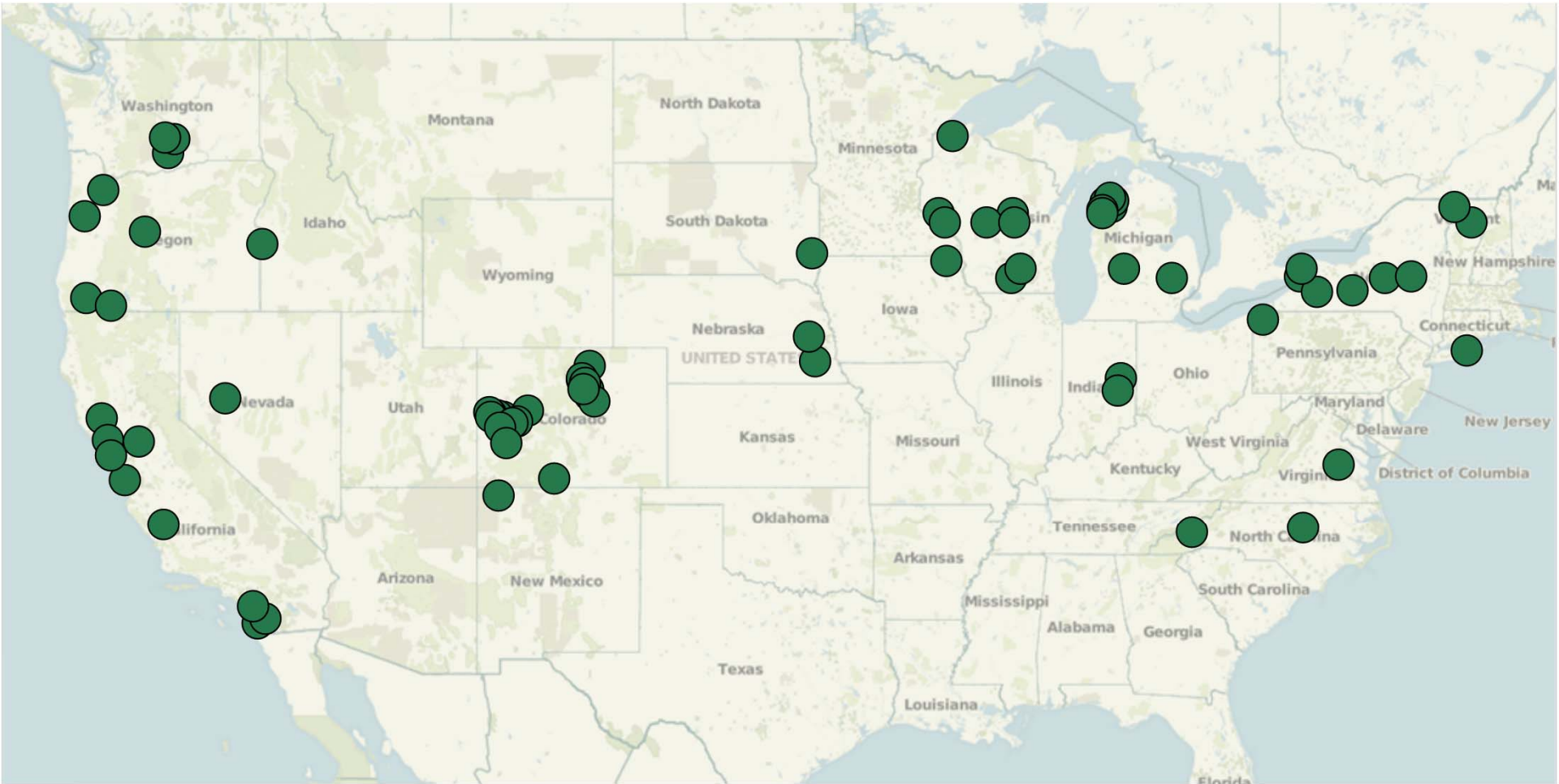
Centennial – Oil by Region

Oil Content



About Tableau maps: www.tableausoftware.com/mapdata

Local Hops – Local Variants...



Varietal Purity

- **Similar to Yeast Management**
 - Clonal propagation from a single parent for multiple generations
 - Accumulates disease over time
 - Susceptible to competition from off-types (other varieties)





Propagation



Establishment

Other factors: Yard age, virus free, males, pest pressure

A photograph of a field with rows of young trees supported by wooden stakes. The ground is covered in green grass. In the background, there is a dense forest of taller trees under a clear sky.

Cover Crops

A photograph of a long, straight dirt path in a field. The path is flanked by rows of young plants supported by wooden stakes. A large, clear blue sky with a few white clouds is visible above the field.

Moonscapes

Other factors: Salmon Safe, Global GAP, Organic, IPM, Fertility...

What's a Brewer to Do?

- A. Embrace Variation and work with growers and suppliers to make the most of it.**
- B. Blend it out to simplify brew to brew consistency and even out supply.**



What Kind of Brewery are You?

Consistent	Variable
Larger	Smaller
Very concerned about scarcity	Can handle substitutions
Batch to batch quality + consistency	Individuality
Year to year consistency	Vintages
Recipes must scale	Likes one offs
Product Driven	Story/Idea Driven



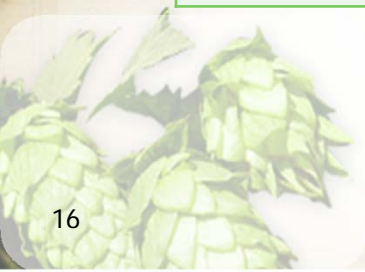
Hops for the Brewhouse - Upsides

Green Hops	<ul style="list-style-type: none">• Fresh off the farm
Whole Cone	<ul style="list-style-type: none">• Tradition, story and as close to the farm as possible
Pellets	<ul style="list-style-type: none">• Lot Specific or Blended, still easy to story tell• Convenience, storability, supply buffering, improved utilization
CO2 Extracts	<ul style="list-style-type: none">• Refined pellets• Better yield, utilization, storability
Downstream	<ul style="list-style-type: none">• Control - take the hop apart into as many pieces as possible then reassemble just the parts you want for your beer• Engineering/Science over romanticism



Hops for the Brewhouse - Downsides

Green Hops	<ul style="list-style-type: none">• Only once a year
Whole Cone	<ul style="list-style-type: none">• Degrades fastest but can be packed in Mylar• Contains the raw stuff from the farm, including sticks, stones...
Pellets	<ul style="list-style-type: none">• Yield losses from trub• Transparency and traceability can be an issue
CO2 Extracts	<ul style="list-style-type: none">• Loss of complexity, harder to trace, changes in flavor
Downstream	<ul style="list-style-type: none">• Homogenous offerings, lack of complexity, “artificial”



Commodity → Specialty

- Cascade is not just “Cascade” anymore
 - It has an origin, and a story



An aerial photograph of a hop farm. The foreground and middle ground are filled with neat, rectangular rows of green hop plants. In the upper right, there is a large, light-colored industrial building with a flat roof, surrounded by a paved area with several parked vehicles. A road curves through the farm, separating the planting areas from the processing facility. The overall scene is a well-organized agricultural operation.

A Hop's Story: Solstice Ale - Centennial

- **CEN 3 – 455 -- 28**

- Kettle additions at 60 min, 30min, WP, KO

- **Farm**

- C & C Hop Farms, 4th generation family farm in Moxee, WA
- Known for Centennial, Chinook, Columbus; adding Citra, Simcoe
- All new picker in 2014, with Perrault harvester and Dauenhauer cleaners

- **Harvest**

- Field Moxee 11 CEN
- Harvested 9 - 2 - 13 on a Dauenhauer, Kilned with natural gas
- 16 sprays total, EU and JP compliant
- 4 salmon unsafe applications, 0 organic applications

3-455-28

- **Harvest Analysis**

- 10.7 Alpha, 2.3 Oil, .252 HSI
- 1.13% Pinene, 67% Myrcene, 1.18% Geraniol
- Brew cuts graded at a 4 out of 5, (very good)
 - “good color and aroma, resins”

- **Pelleting**

- Lot 1445
- Ran at HU 10-21
- 9.5% Alpha, .320 HSI
- 95.8% Yield



Variation Starts with Consistency

- Establish consistency in brewing, cellar, and packaging processes
- Keep excellent records
- Know your beer, QA/QC and taste panel
- Create options - Find many places to add hops
- Get as much info about your hops as is available



Post Boil Methods

- Goal is to extract flavor and aroma
- Bitterness is a BY-PRODUCT
- Contact time, agitation and temperature

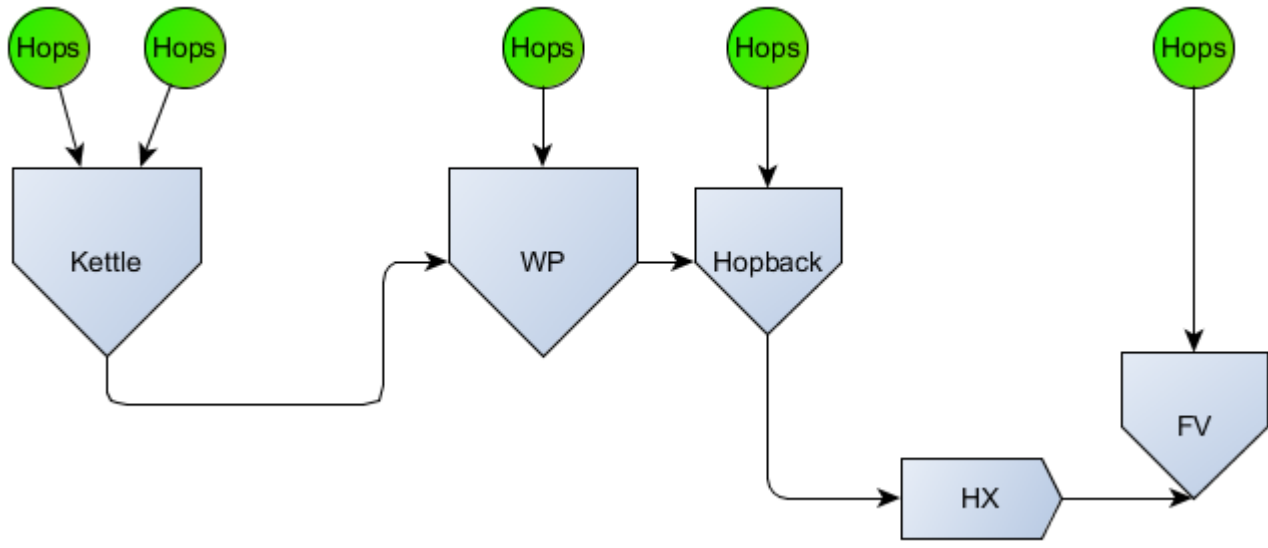
(4) Hop oils are largely volatile in steam so that where hops are added at the beginning of boiling most of the oil is lost—and indeed needs to be, because the amount of oil present in the hops needed for bittering would make the beer unpalatable. Nevertheless, ale brewers have then to resort to dry-hopping to improve beer flavour and aroma whereas lager brewers use a small amount of hops in the copper late in the boil for the same purpose.

1965...

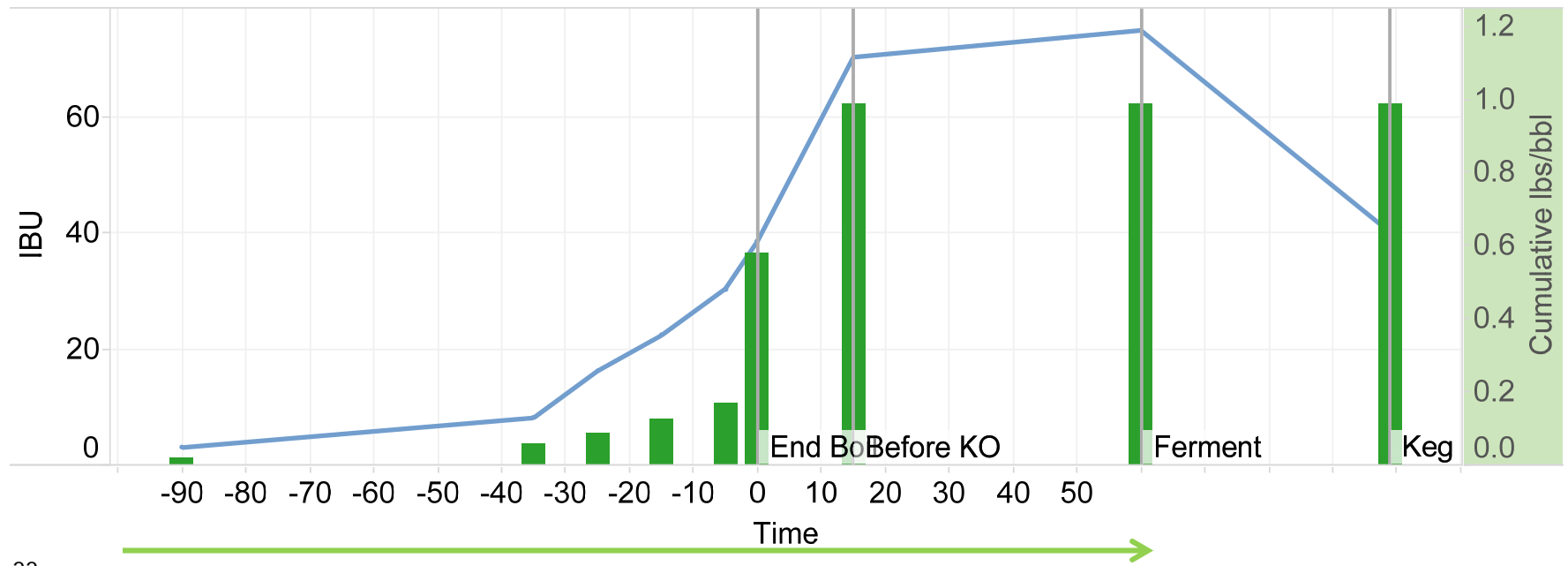
THE RATIONALIZATION OF HOP UTILIZATION—A REVIEW

By J. R. HUDSON, PH.D., F.R.I.C.





Hop Utilization



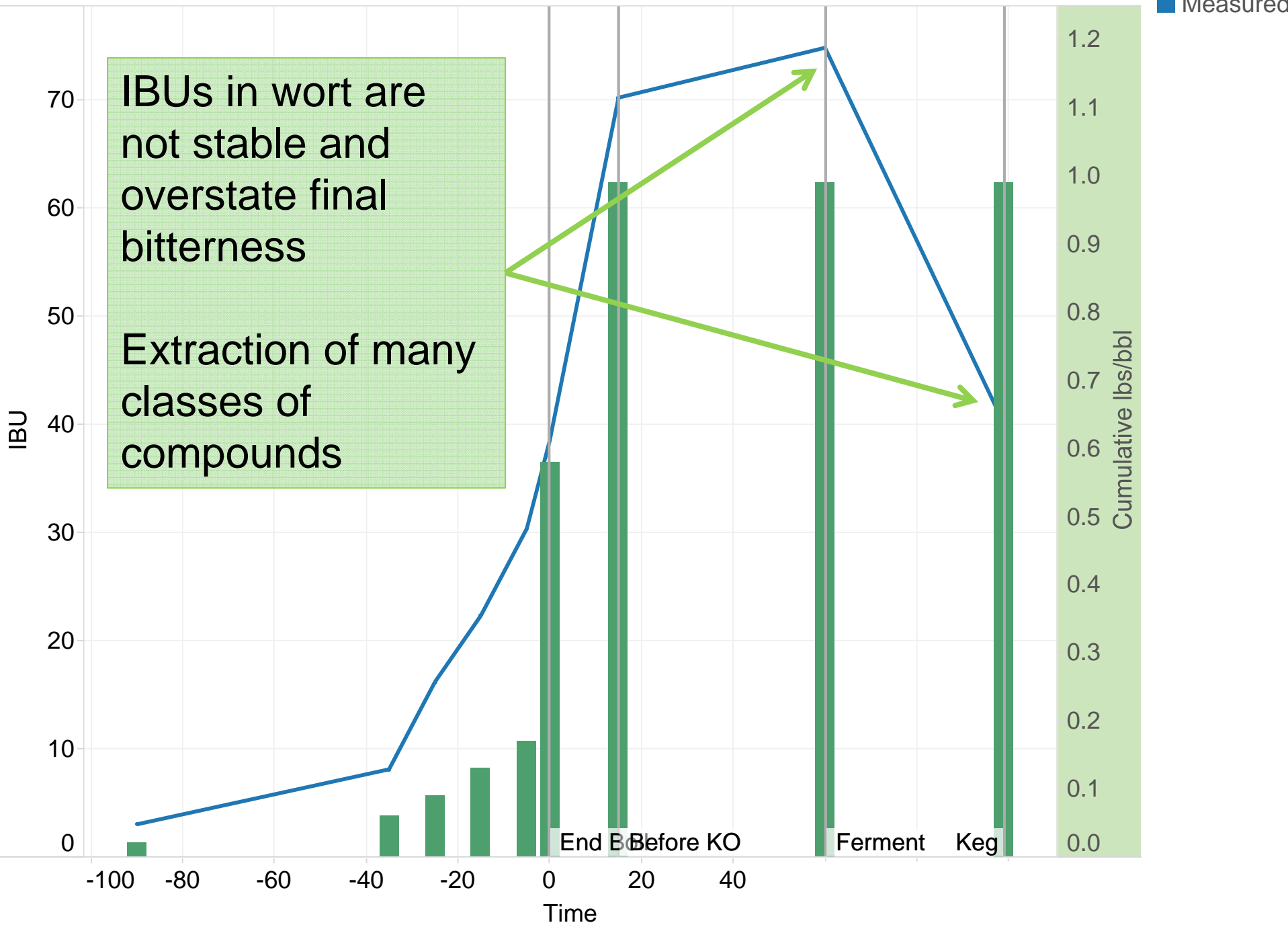
Considerations

- **Late and Whirlpool additions increase trub load dramatically**
 - Standpipes, larger settling capacity, accept losses
- **Late additions in the lb/bbl range contribute significant bitterness**
 - Measurement of wort IBUs is very misleading
- **Attention to time and temp post boil is important for consistent bitterness**
- **Utilization is strongly brewery dependent**
 - Hot break, cold break and yeast losses
 - Volatilization of oils
 - Extraction temperature – vessels, transfers, elevation

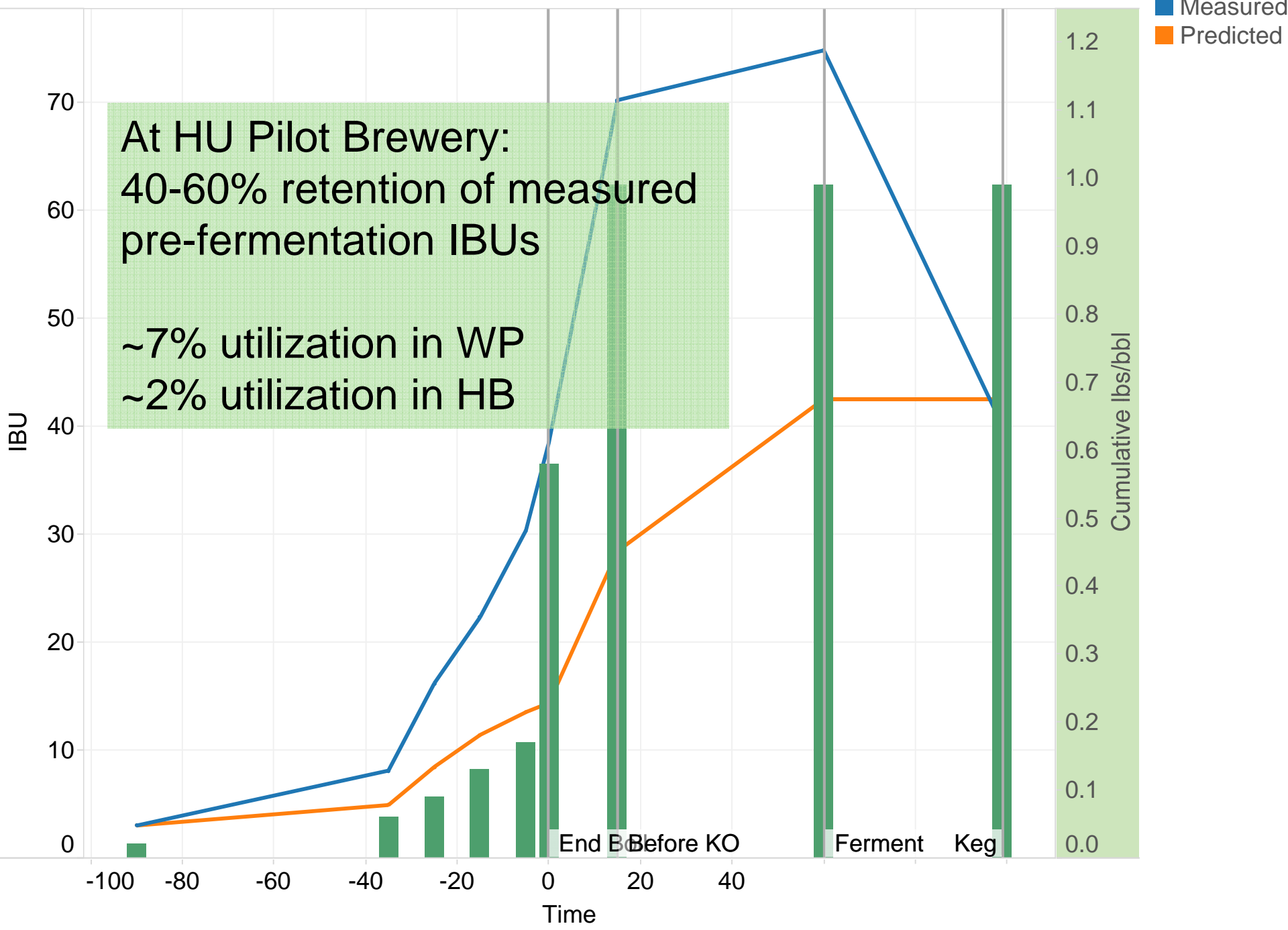


Measured VS Predicted IBUs

Brew
■ Measured



Measured VS Predicted IBUs



Hopback Designs

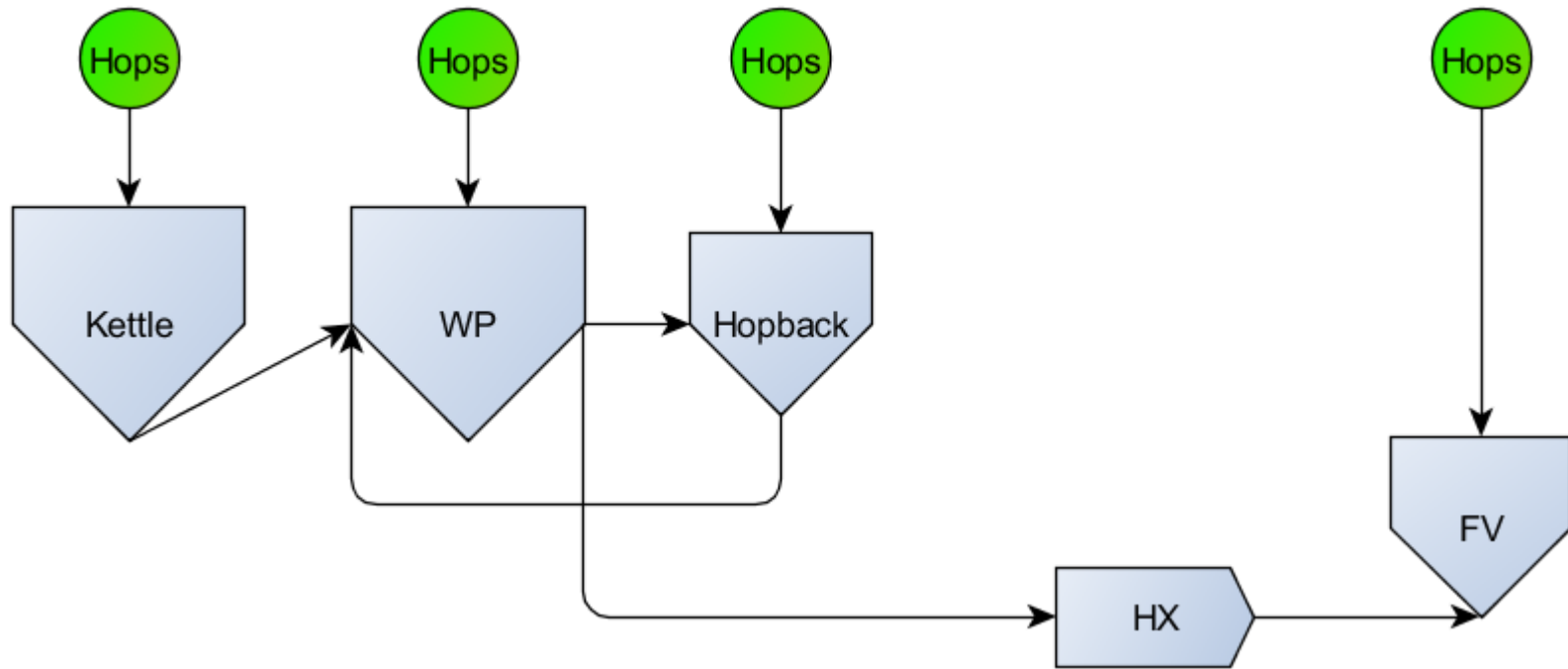
- Old timey tech to separate whole hops from wort
- Filter out hot break much like a lauter tun removes haze
- Greatly expand range of options for extracting hop aroma
 - Allow use of whole hops in otherwise pellet/extract breweries
 - Small lots
 - Experimental hops
 - Local hops
 - Green hops
- **Most flavor per IBU**



Horizontal – Bale Breaker Brewing



Bale Breaker Process



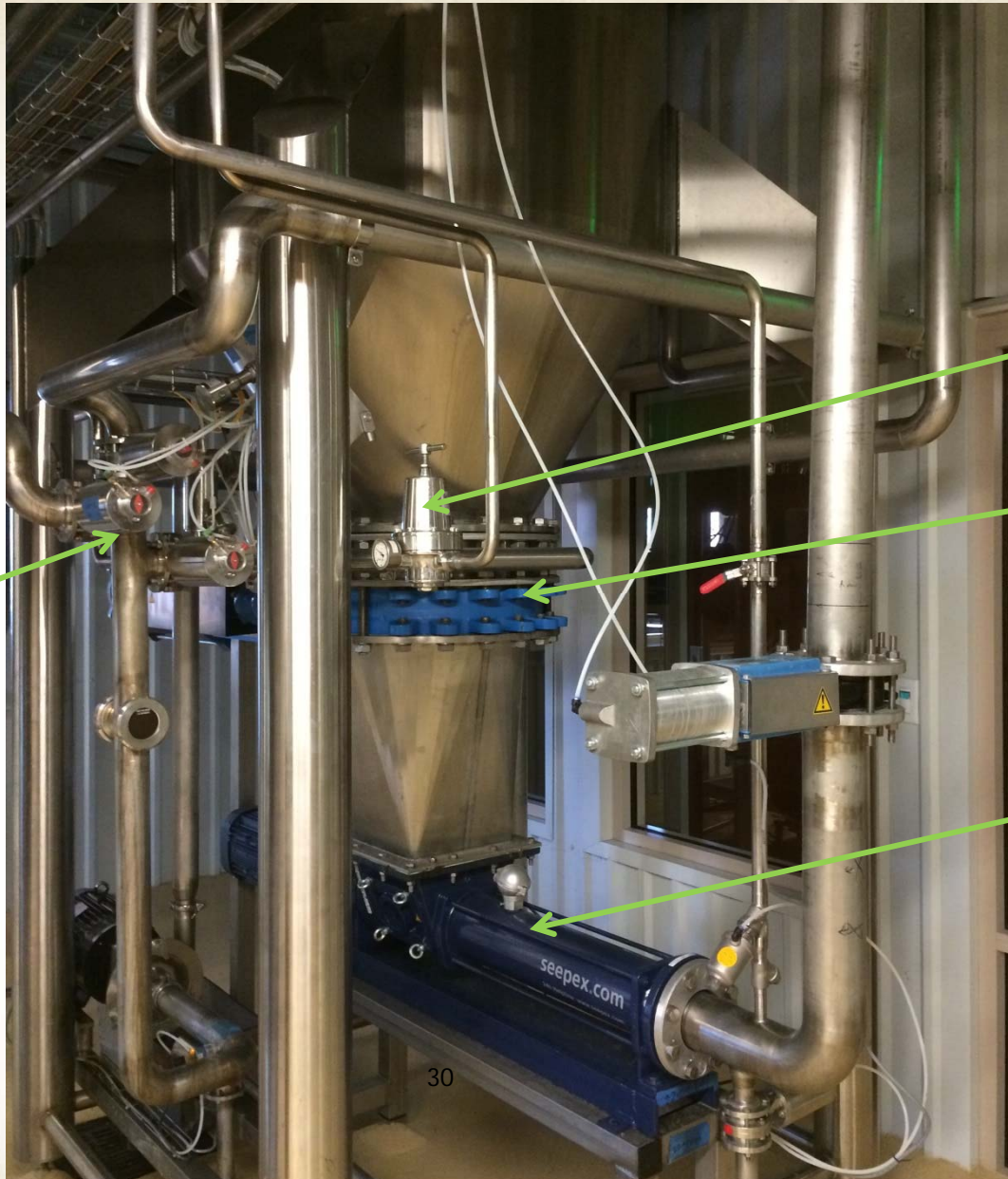
- Kettle → WP
- WP → HB → WP recirc
- WP → HX
- Very clear wort, low final temp
- Manual clean out



Vertical – Odell Brewing Co



Vertical – Odell Brewing Co



Inlet Manifold

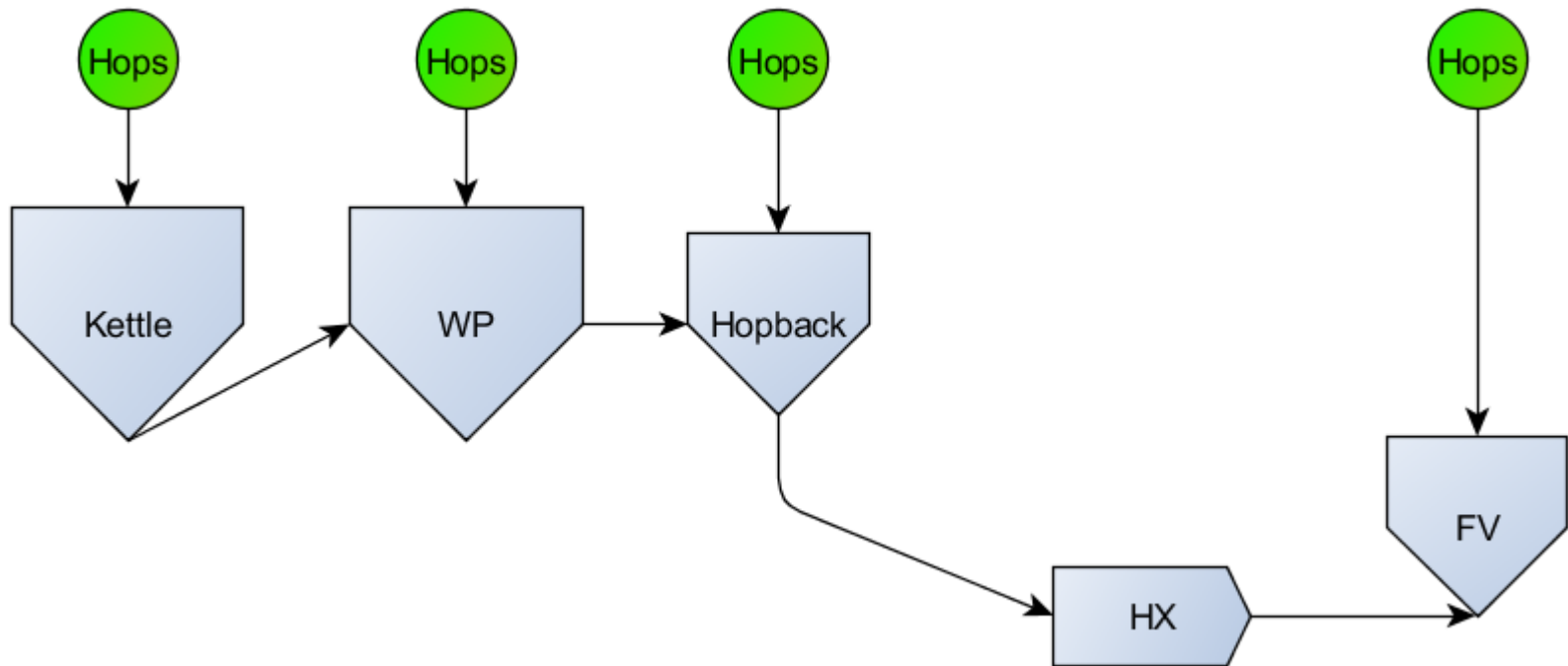
CO2 Purge

Slide Gate

PC pump to
spent grains silo



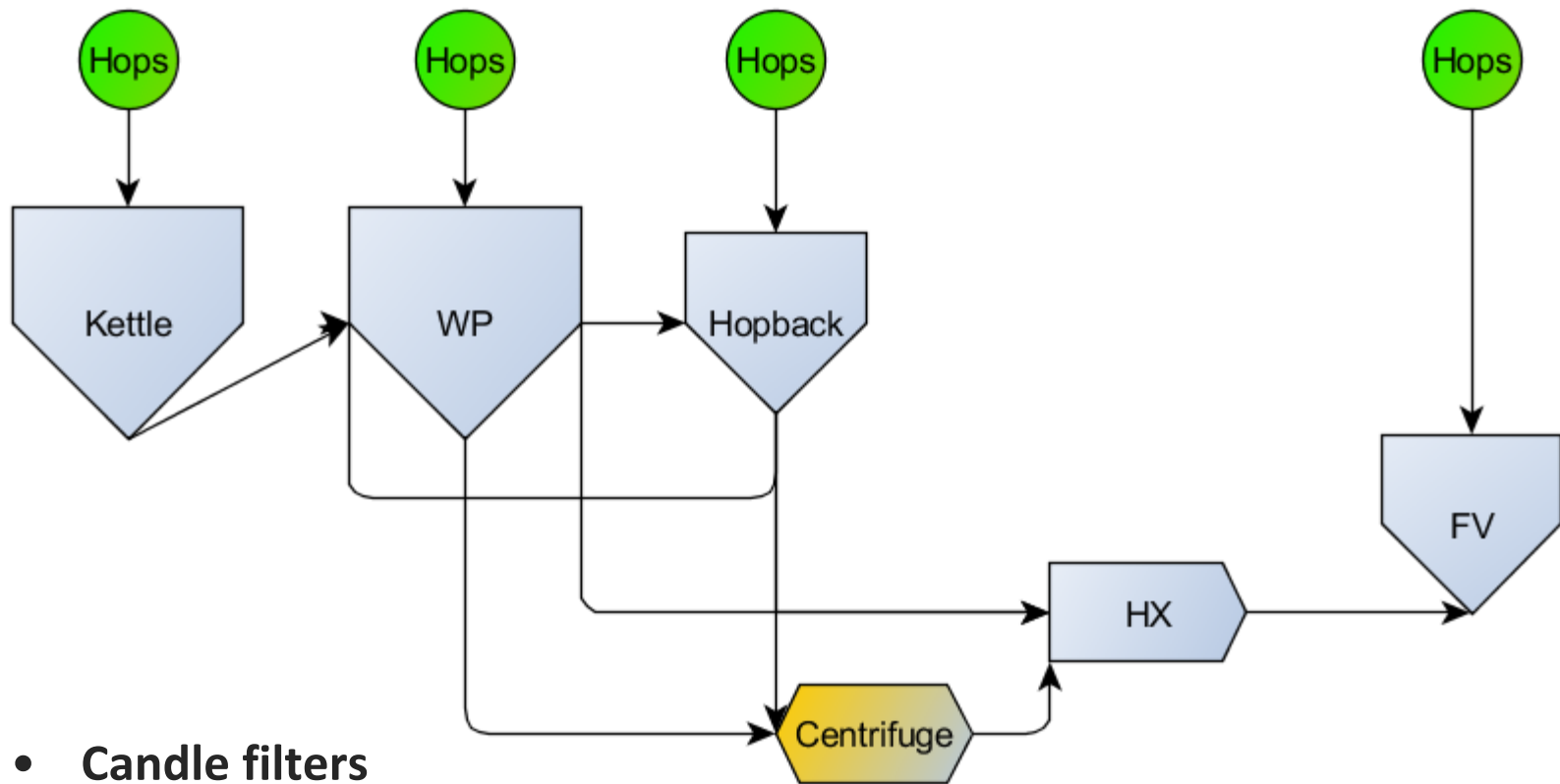
Odell Brewing Process



- Kettle → WP → Hopback → HX
- 5 minutes of aggressive agitation to incorporate cones. Longer plugs screens, increases trub
- Good filtration of trub
- “Closed hopbacks give better aroma”
- Automated cleanout and CIP



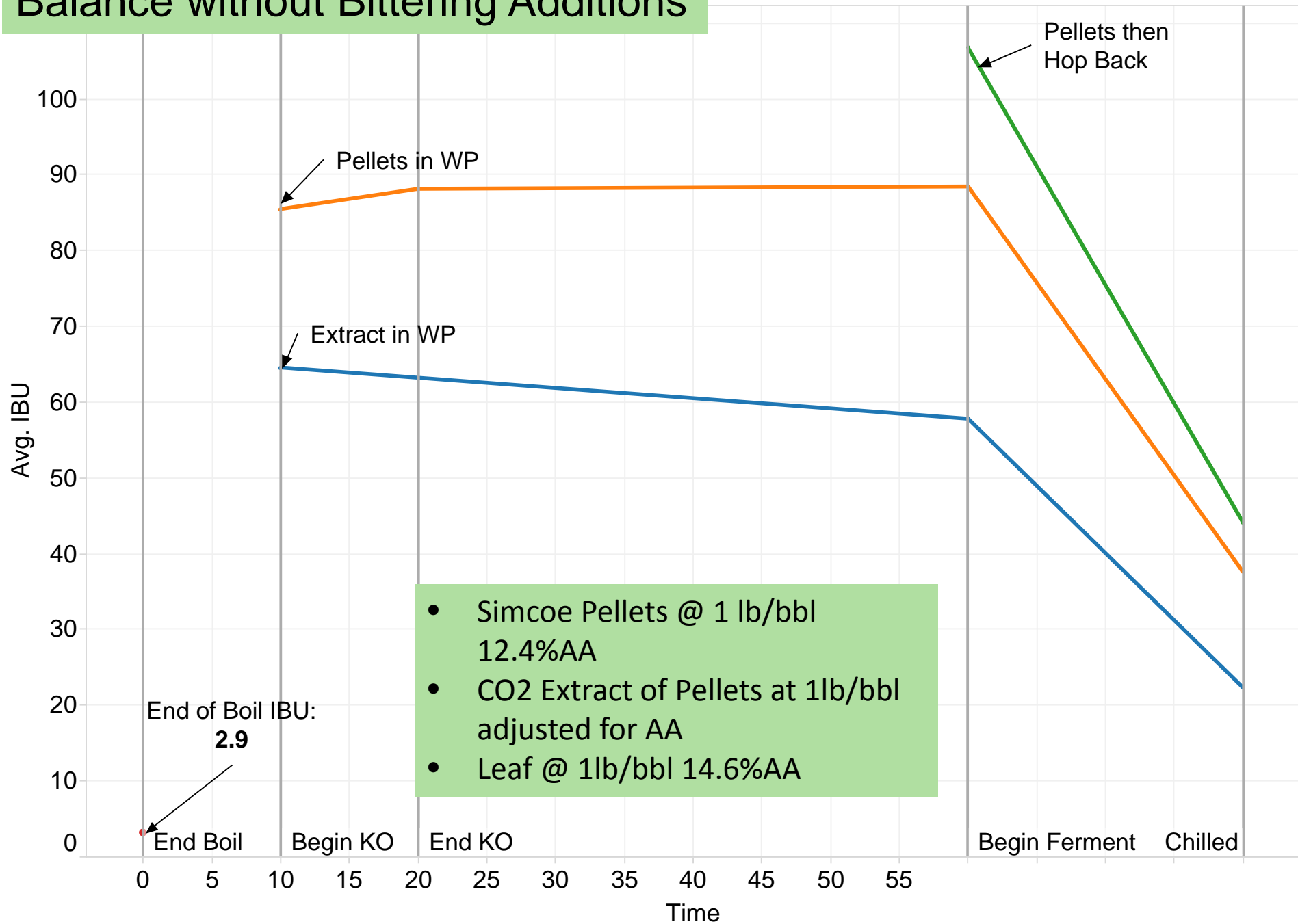
Room for Innovation



- **Candle filters**
- **Horizontal strainers with dewatering screws**
- **Grape destemmers**
- **Centrifuge**
- **Steeping temperature**



Balance without Bittering Additions



END.



Grower Feedback

Confidential - Property of Hopunion and Grower

2013 Lot Analysis and Selection

Wednesday, March 12, 2014



MOSAIC™ HBC 369 CV.

G032 -

Harvest Date	Lot ID	HU ID	Bales	Net Lbs	Kiln Depth	Kiln Temp	Min Moist	Max Moist	Alpha	Beta	HSI	Oil	Seed	Stem	Visual/ Aroma (1-5)	Shown	Brewers Preferred
9/20/2013	3-381-68	251	150	30370	28	130	10.5		13.3	4.0	0.264	2.8			3.5	11	73%

Brew Cut Comments: nice aroma, big resins and oil, good color, dry and fluffy

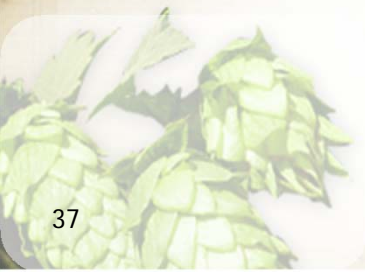
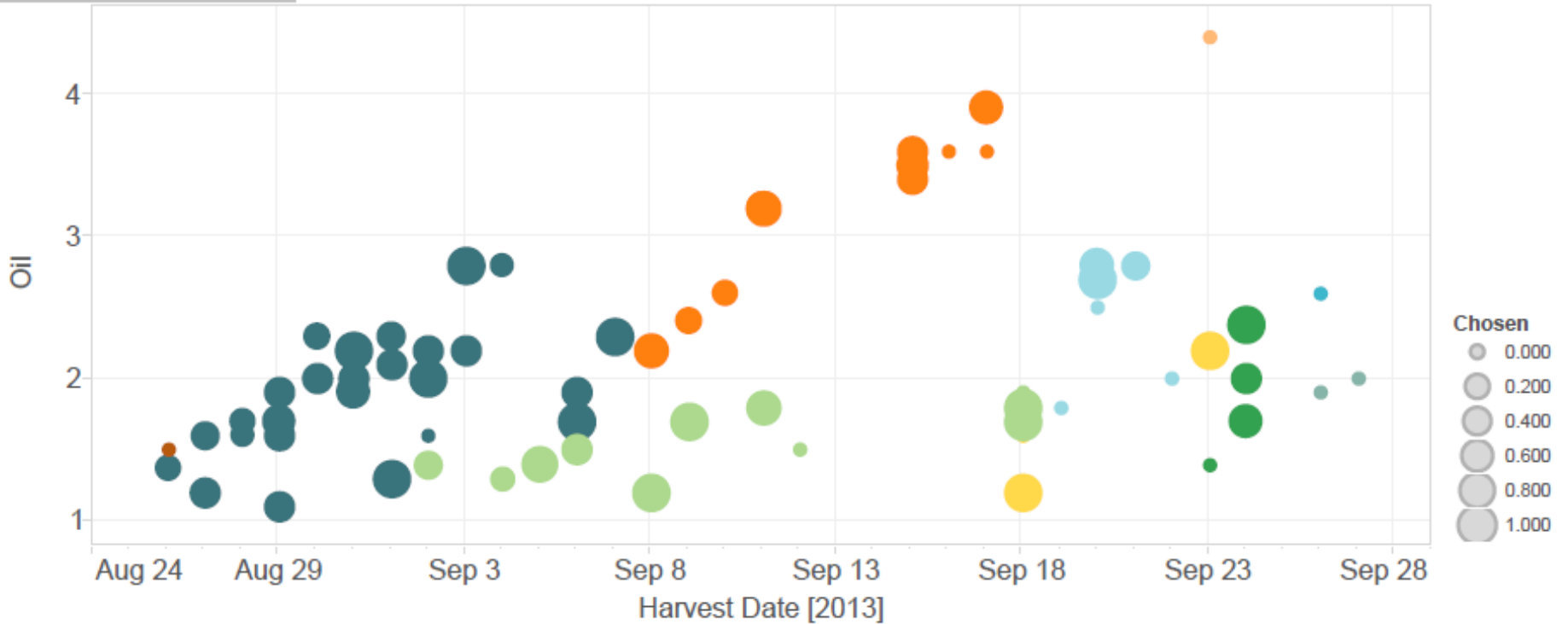
Export Status: US EU JP
 PASS PASS PASS Spray Guidelines

Customer	Lbs Selected	Ranked	Comments
[Redacted]	9428.18		
	2636	1	
	8288.28	1	by far the best
	3597.66	1	
	2094.84	1	
	1821.6	1	
	865	2	
	1639.44	2	
		3	
	0	3	



Grower Feedback

Oil vs Harvest Date



Oil Profile as a Diagnostic

Vial 208:

