

Dryhopping Effectively

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HOP ANATOMY

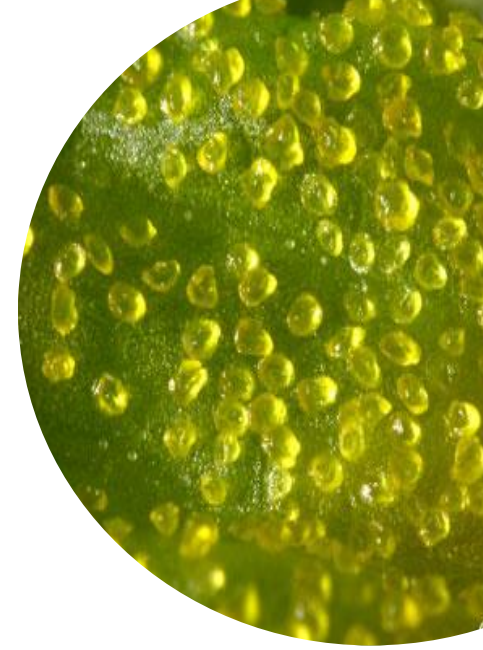


Lupulin

Leaf/Bract

Alpha Acids 2-20%
Beta Acids 2-20%
Hop Oils 0.5-4%
Lipids 1-5%

Polyphenols
& Tannins 3-6%
Terpene-Glycosides
Cellulose 40-50%
Proteins 15%
Water 8-11%



PRODUCTS



GREEN HOPS®
WHOLE, WET
HOP CONES



LEAF HOPS
WHOLE, KILN-DRIED
HOP CONES



HOP PELLETS
T-90 PELLETS
& PELLET BLENDS



CRYO HOPS™
LupuLN2™ & Bract



RESINATE®
CO₂ HOP EXTRACT
And
ADVANCED PRODUCTS

What is Dryhopping?

Blaze's Definition:

Quite simply, dryhopping occurs whenever hops are added to beer/wort after the beer/wort has been chilled post boil.



Why Dryhop a Beer?

- Increase Aroma
- Add different flavors and aroma to beer
- Maintain hoppy flavor longer



Selecting Hops for Dryhopping

Considerations:

- Variety
- Supplier
- Form of Hop to use
- Quality

Varietal Selection

- Higher Alpha, Higher Oil when possible. In general you can use less volume of hops and achieve similar aroma/flavor intensity....which means more beer!
- Avoid storing varieties. CTZ, Centennial, etc. They store poorly both inside and outside of beer.
- Do you want piney/grassy/citrusy/tropical/fruity? There are so many options out there.

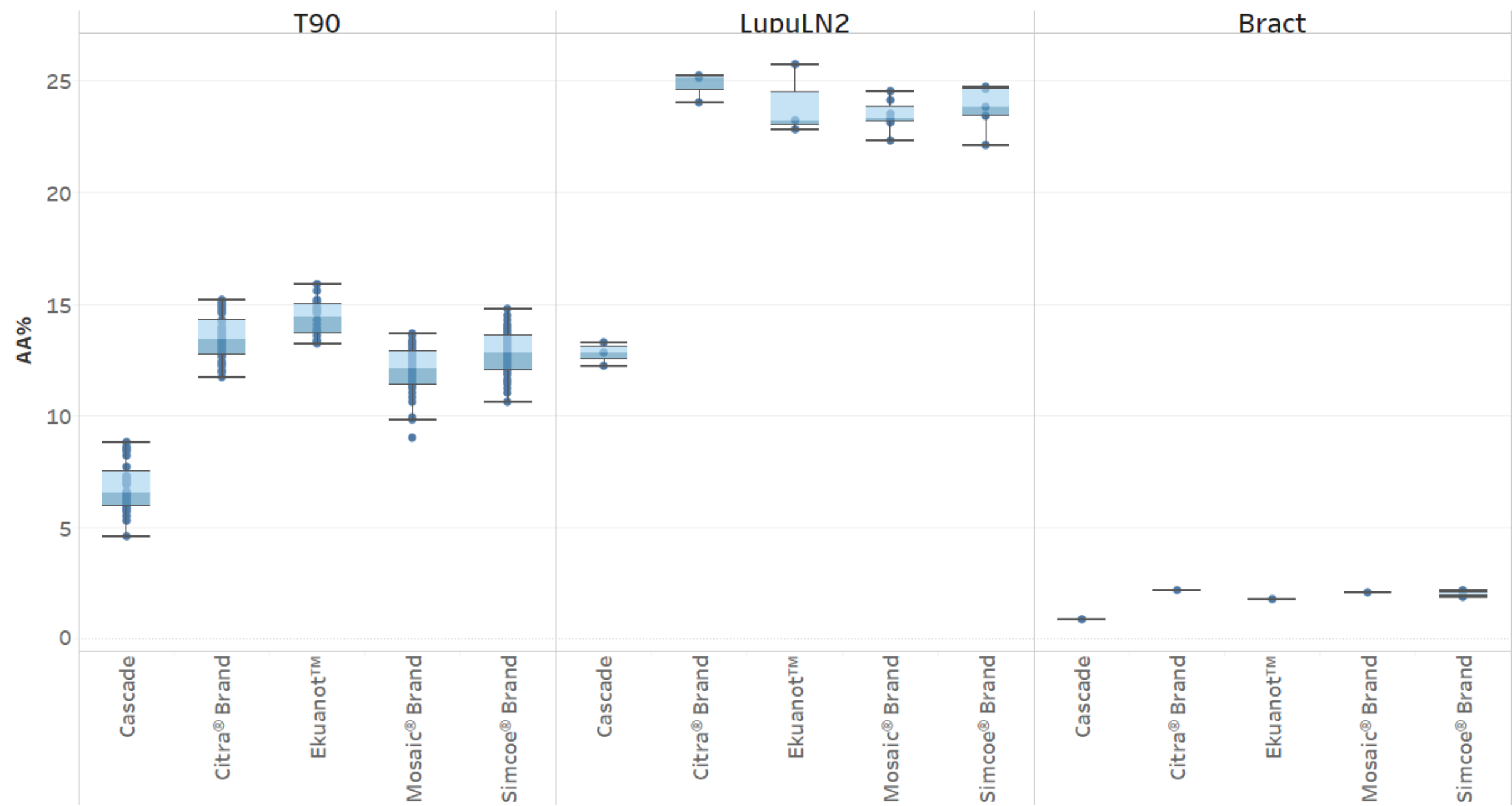
Hop Supplier Recommendations

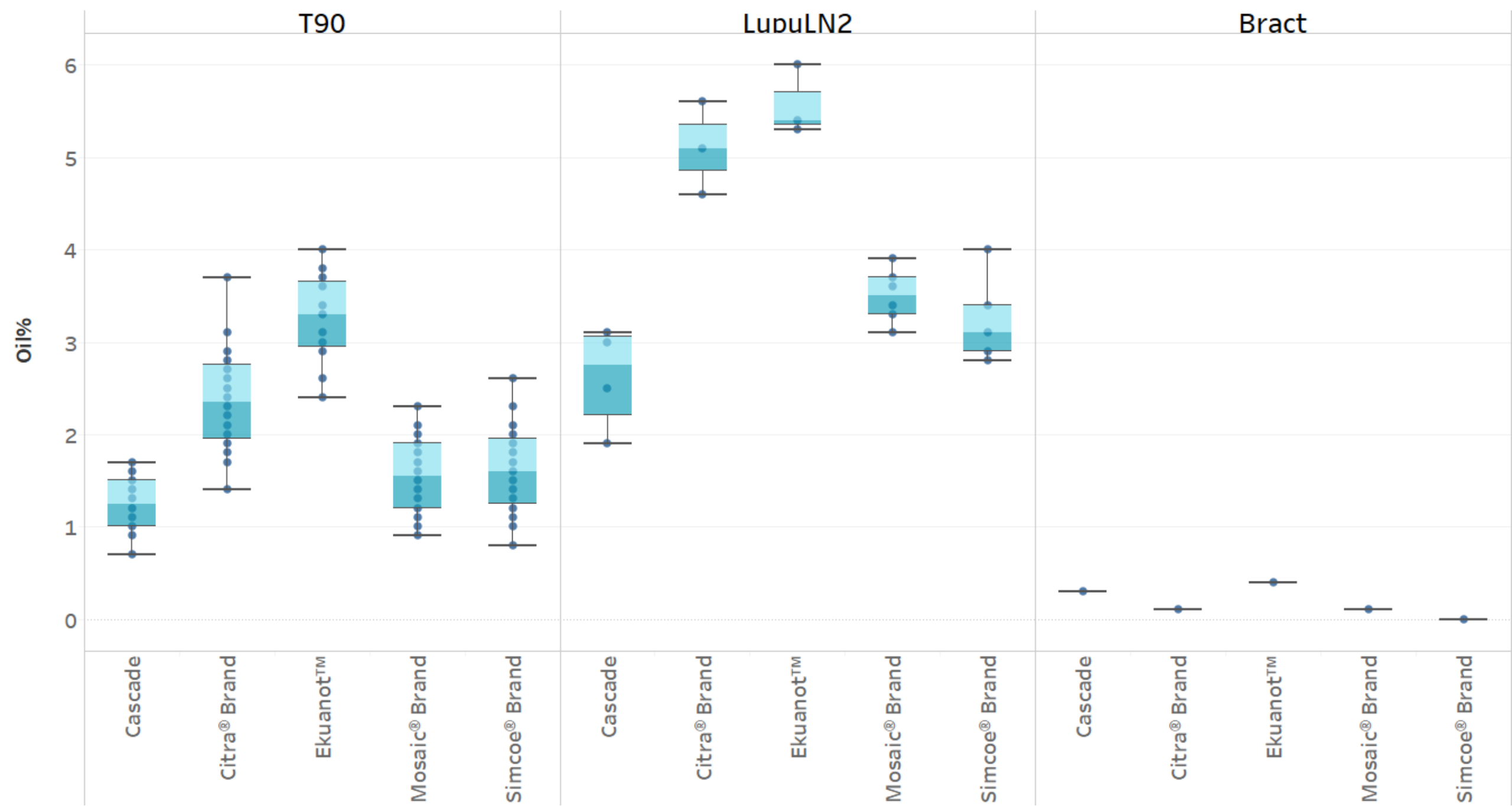
Stick with reputable mainstream suppliers, with quality packaging systems.

- **Nitrogen purged packaging a plus.**
- **Hard pack/Vacuum Sealed is fine too, as long as it is hard**
- **Smell the hops before dryhopping, if they smell bad don't use them.**

Choosing the right form of Hops to Dryhop

- Whole Cone-** Common in Homebrewing, least efficient option
- Pellets T90-** Most Common in the industry. Moderately efficient
- CryoHops-** New to the Industry. Most efficient. Use $\frac{1}{2}$ the volume of T90 get similar intensity.





Know Your Hops Enemy

- **Oxygen**
- **Long Term Storage Temperature**
- **Time...not much of a factor with Pellets**
- **Pelleting/Processing Quality**

Process Basics:

- Avoid Hard Water. Filter and add your salts. I prefer gypsum as my primary salt, based on my local water profile.
- Keep mash and runoff pH 5.3-5.8. Acid malt at 1-3% can totally be the trick to this. Get a pH Meter and track on your brew sheet.
- Boil off DMS. You should be losing @ least 8% volume...my opinion. Hops can help cover up DMS, but it is still there muddying the beer.
- Clean Yeast, nutrient, and proper pitch rate
- Oxygenate wort as best as possible
- Fermentation Temperature is HUGE!!

Dryhop Specific Process Variables:

- When and where to Dryhop?
- Temperature of Dryhopping
- Dosing Rate...Will come back to this in Recipe Formulation
- DryHop Duration and Conditioning
- VDK concerns/awareness

When to DryHop?

Lots of ways to do this all depends on what you would like to achieve.

My preference:

Add dryhops when your beer has fermented within 0.5 to 1 degree plato(.004 SG) of terminal gravity, so tail end of fermentation.

Have had great beer that was dryhopped further from terminal, yeast metabolites may play a role in transforming flavor and aroma.

Where to Dryhop?

Depends on your temperature range goals.

For higher temperature(60F-70F):

I prefer with some yeast in suspension in primary fermenter. If possible remove settled yeast from bottom of fermenter before dryhopping.

Carboy vs. Conical vs. Pressure holding Conical to be explored in Equipment section

Dryhop Temperature

Lots of options on this, really depends on what you want to achieve.

3 categories to discuss:

- 1) 60F to 70F- Emphasis on fruity, juicy, citrus compounds. Increased efficiency and increased VDK...need longer secondary rest.
- 2) 50F to 60F- Balance between Fruity, Juicy, grassy, piney, earthy aromas and flavor. Decent Efficiency and moderate VDK
- 3) Below 50F- Emphasis on harsher grassy, vegetal flavor and aroma

Dry Hop Duration and Conditioning?

Schedule for warm dryhopping 60F-70F:

5-7 days of warm contact time(after adding hops)

2-3 days crash temperature to settle trub

Transfer into Secondary vessel, separating the trub (hops and yeast)

I strongly recommend removing beer from trub once settled out, otherwise you will leach some of the grassy, woody, earthy flavor/aroma like if you were dryhopping too cold.

VDK(Vicinal Diketones)and Dryhopping

Why it is happening?

In your beer there is some unfermentable sugars(dextrins, etc.) that ale yeast cannot readily digest.

In hops there is some glucose and enzymes.

Glucose = Fermentables

Enzymes + Unfermentables = Some fermentables

Fermentables + Yeast = some VDK

VDK + Yeast + Time = more drinkable beer...

Equipment Considerations

4 common types of fermenters used in homebrewing

I have used all of these 4 types...Avoid plastic for many reasons!

- 1) Carboys
- 2) Conical(non-pressure holding)
- 3) Conical(pressure holding)
- 4) Modified Kegs

Carboys

Typically 5 or 6 gallon flat bottom glass jugs

Advantages:

- You can see what is going on
- Easy to swirl/mix in dryhops
- PIA to siphon from...O2 pickup

Disadvantages:

- If they break...major safety hazard
- Do not hold pressure
- Trub removal can be a challenge



Conical(non-pressure holding)

Sizes range, but generally available for many brewhouse sizes

Advantages:

- Easy to swirl/mix in dryhops
- Easier transfer than carboy
- You can Hot Kill!!!

Disadvantages:

- Do not hold pressure



Conical (pressure holding)

Typically only larger sizes available

Advantages:

- Easy to swirl/mix in dryhops
- Easier transfer than carboy
- You can Hot Kill!!!
- Holds pressure...more hop aroma
- Some have temperature control

Disadvantages:

- Expensive
- Not many available for small(5 gallon) batch sizes



Modified Kegs

Typically only larger sizes available

Advantages:

- Easy to swirl/mix in dryhops
- Easier transfer than carboy
- You can Hot Kill!!!
- Some Hold Pressure

Disadvantages:

- Flat bottom, trub removal/clogging can be an issue



Example of Recipe Formulation

Beer I am targeting:
Hoppy American Strong Pale

OG: 14-15 Plato

TG: 2-3 Plato *Apparent Extract, per hydrometer*

ABV: 5.5-6.5 ABV

IBU: 50-60

Color: less than 6 SRM

Grist Base

2 Row: 90%

C10/15: 1.5%

Munich: 5%

Dextrin: 2%

Acid Malt: 1.5%

Goal: Solid Malt Backbone for all the hops I will be throwing at it, but...need to suppress aging compounds specific to crystal malts. Over time they will take over your beer and mask the hops. My goal is a super hoppy yet refreshing beer that can remain drinkable for months.

Hot Side Hop Schedule

Hot Side: Use brewing calculator to dose IBU, except the flameout

90(or 60) minute: ~20 IBU CO2 Extract

15 Minute: ~15 IBU Cryo Hops

Flameout: ~20 IBU CryoHops

Flameout dose should be in the 0.5 oz Cryo pellet per gallon range

*Flameout addition IBU contribution is very process specific. I require a quick knockout whenever possible, otherwise bitterness will increase while aroma is reduced by heat exposure.

Cold Side Hop Schedule

Cold Side

When beer is 0.5 to 1 Plato before reaching terminal gravity it is time to add your dry hops.

Dose at 0.5 oz./gallon

6 days later, crash cool your fermenter.

3 days later, transfer to secondary vessel. Keg or Corney can recommended.

Thanks Very Much!

Questions???