

Send In the Clones: Sensory  
Analysis and Recipe  
Formulation Techniques for  
Homebrewers

Please welcome our participating brewers and thank them for the truly world-class ales they have provided as samples:

Evil Twin, Heretic Brewing Company, Fairfield, CA  
Brewer: Jamil Zainasheff

Stone IPA, Stone Brewing Company, Escondido, CA  
Brewer: Mitch Steele

## Methods you can use to improve your cloning success

1. Familiarize yourself with ingredients to train your senses
2. Perform a sensory evaluation & take notes
3. Research your target beer
4. Build your recipe
5. Brew, take careful notes, evaluate, repeat as needed

Sensory evaluation and best-guess recipe: Evil Twin

Sensory evaluation and best-guess recipe: Stone IPA

How close to a target craft beer can we reasonably expect to

Exact replicas of craft beers are tough, but not impossible.

Clone or Homage?

Lowering the difficulty level

- Stick to classic styles vs. innovative beers
- Simpler is better, both for home brewers and craft brewers
- Use the following 5 methods

# Methods you can use to improve your cloning success

## 1. Familiarize yourself with ingredients to train your senses

### Malt

Taste base malts and specialty grains

Brew with as many malt varieties as possible

### Hops

- Leaf Hops: the rub and sniff
- Pellet hops: the Bud Light flight
- Mitch: how do Stone brewers decide on new hop varieties

Brew with as many hop varieties as possible

### Yeast Strains

read Chris and Jamil's *Yeast: The Practical Guide to Beer F*

Brew with as many yeast varieties as possible

# Methods you can use to improve your cloning success

## 2. Perform a sensory evaluation of the beer & take notes

Think like a beer judge, but also think like a brewer

- multi-layered merits
- multi-layered flaws
- sensitivity to certain compounds varies among tasters

Knowledge of style: What a classic example should taste like

Brewers: How can I achieve this result in the brewhouse?

### Sensory Evaluation:

- Appearance (color, foam structure, density)
- Aromatics (olfactory)
- Flavor (olfactory)
- Palate (taste, mouthfeel)
- Finish (aftertaste)

# Methods you can use to improve your cloning success

## 3. Research your target beer

- The brewer is the best source of information about a beer
- Brewery websites
- Podcasts (e.g. *Can You Brew It*, *Jamil Show* - Brewing Network)
- Books
- Brewing forums (fellow cloners who've attempted the same)
- Beer review websites

# Methods you can use to improve your cloning success

## 4. Build your recipe

### Brewing software

- Best for recipes by percentage
- Not so great if you have a list of ingredients but not amounts

Total color - the same EBC or SRM could come from a t of roast, a large amount of caramel malt, or Maillard react

Total IBUs - bitterness calculations vary; whirlpool addition still contribute bitterness; dry hopping does not factor into calculation, but still adds perceived bitterness/astringenc

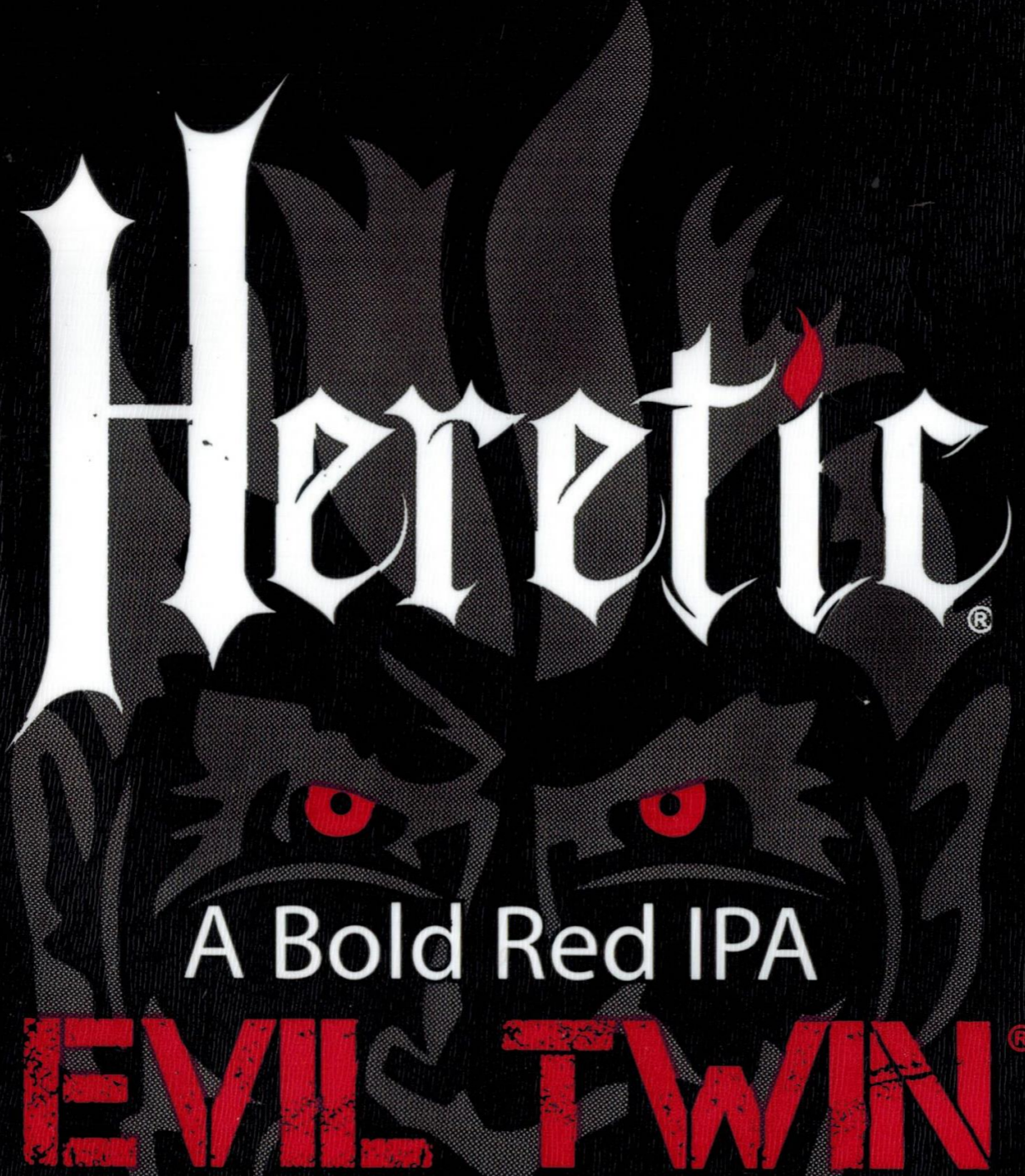
Read Mitch's *IPA: Brewing Techniques, Recipes and the of India Pale Ale*



## Methods you can use to improve your cloning success

### 5. Brew the beer, take careful notes, repeat as needed

- Evaluate your beer objectively side-by-side with the original.
- Theorize on what needs to be changed next batch.
- Share your findings with the community.
- Be open to the possibility that while not exact, you may find your result better than the target beer.



MF809/15/14L07174

A Bold Red IPA

**EVIL TWIN**

Red Ale

1 Pint 6 FL. OZ. (650 ml) – 6.8 % Alcohol By Volume  
Brewed and bottled by Heretic Brewing Co. – Fairfield, California

Don't follow the crowd. Be a Heretic and drink responsibly.

**CA CRV** CT-IA-ME-MA-VT-NY-DE 5¢  
OR-HI 5¢ MI 10¢ OK+ FL



This blood-red ale may not be what you might expect from a malty and hoppy craft beer. Evil Twin has a rich malt character, without being overly sweet. It has a huge hop character, without being overly bitter. It is a great example of a bold, rich, balanced craft beer, without being heavy and hard to drink in quantity. Our Evil Twin is only bad because it is too good to resist.

**GOVERNMENT WARNING:** (1) ACCORDING TO THE SURGEON GENERAL, WOMEN SHOULD NOT DRINK ALCOHOLIC BEVERAGES DURING PREGNANCY BECAUSE OF THE RISK OF BIRTH DEFECTS. (2) CONSUMPTION OF ALCOHOLIC BEVERAGES IMPAIRS YOUR ABILITY TO DRIVE A CAR OR OPERATE MACHINERY, AND MAY CAUSE HEALTH PROBLEMS.



# Evil Twin Red IPA - Review

Evil Twin Red Ale

Heretic Brewing Company, Fairfield, CA

Described as a bold red IPA, Evil Twin gets a good dose of hop aroma, forest loam and pine sap mainly. Garnet red with voluminous whitish foam, it's brilliantly clear despite a trace of yeast sediment. Dark crystal malt is initially heavy on the palate, but dries pleasantly to a just-dry 45 IBUs. At 6.8% abv, this red isn't cloying or sticky, though it certainly has the heft; brewer Jamil Zainascheff has an adept hand at balancing his beers to retain a devilish drinkability.

# Evil Twin Red IPA - Sensory Evaluation

## Appearance

### Color - Deep red (20 SRM)

- Garnet color nearly spot-on for about 15% 80L; maybe a little darker
- Slight contribution (3%?) from black or roast may be responsible for deepening the red hues.

Clarity - bright, but with visible sediment in the bottle. From the tight density of the foam, almost definitely all barley malt, and probably bottle conditioned.

Carbonation - medium to medium-high, (2.5 vol?); fine bubbles.

# Evil Twin Red IPA - Sensory Evaluation

## Aromatics

Malt - 80L crystal, possibly English; more fruit and biscuit than domestic crystal. Base malt probably domestic 2-row.

Hops - Major addition either dry or whirlpooled (or both) contribute clean, forward oil aromatics. Definitely American hops, but no skunk or catty notes; lemon, grapefruit rind, some raw conifer; faint tropical fruit. Not Cascade, not Chinook. Columbus, Citra, maybe Centennial?

No vegetal or grassy off-aromas; whirlpool hops likely, perhaps with a brief dry-hopping.

Yeast - Clean, only slightly fruity signature, accentuates

## Flavor Evil Twin Red IPA - Sensory Evaluation

Malt sweetness (palate) - initial fullness, velvety malt texture, then dries abruptly to IPA-like palate. Definite transition from heavy to dry, but sweetness, if there is any, does not linger long.

80L crystal malt flavor (olfactory) - Seamless transition from aroma, but recedes behind hop flavors on the palate.

Hop flavor (olfactory): "C" hops: Columbus, Citra, perhaps Centennial. Mostly earthy citrus and pine (CTZ), with a hint of tropical pineapple (Citra).

Other: ale yeast fruitiness of apple and pear mostly hidden behind hops bravado; ester flavors evident on exhale as the beer warms

## Evil Twin Red IPA - Sensory Evaluation

Palate weight/dryness: Medium palate weight from crystal malt, despite thorough attenuation. Dry aftertaste, just short of bitter. Finishes with forward pine- and citrus-heavy hop oils from kettle contribution, balanced by crystal malt fullness, but minimal sweetness. Alcohol dryness plays a lesser role.

Carbonation: medium carbonic acid contribution accentuates hop dryness.

Alcohol: No fumes or volatility apparent, but dryness bolsters hops. Great attenuation. Still think it's the Chico yeast strain.

Water: Soft, carbon filtered to remove chlorine at least; possibly reverse-osmosis. Treatment with minimum amount of calcium chloride to bring malt roundness

## Clone Techniques Seminar – Best-Guess Recipe for Heretic Evil Twin

American IPA (14 B)

Est Original Gravity: 1.063 SG

Est Final Gravity: 1.012 SG

Estimated Alcohol by Vol: 6.7 %

Bitterness: 48 IBUs

Est Color: 19 SRM

Mash: Single Infusion Mash, Light Body, No Mash Out

Sparge Water: 5.99 gal

Sparge Temperature: 168.0 F

Water: Reverse Osmosis treated with 1g/gallon calcium chloride

Batch Size: 5.50 gal

Boil Time: 90 min

Efficiency: 75.00 %

### Ingredients

11 lbs Pale Malt (2 Row), US (2.0 SRM) 85.9 %

1 lb 9 oz Crystal Malt (75 SRM) 12.2 %

4 oz Roast Barley, UK (500 SRM) 2%

0.25 oz Citra [12.00 %] - Boil 60.0 min, 8.9 IBUs

0.25 oz CTZ [14.00 %] - Boil 60.0 min, 10.4 IBUs

1.25 oz Citra [12.00 %] - Steep/Whirlpool 20.0 min, 13.5 IBUs

1.25 oz CTZ [14.00 %] - Steep/Whirlpool 20.0 min, 15.7 IBUs

1 oz Citra [12.00 %] - Dry Hop 3 Days, 0.0 IBUs

1 oz CTZ [14.00 %] - Dry Hop 3 Days, 0.0 IBUs

California Ale (White Labs WLP001) – 1L starter

Mash PH: 5.20

Mash at 150 F for 75 min.

Sparge: Fly sparge with 168.0 F water.

Ferment at 67.0 F for 7 days.

Dry Hop at 67.0 F for 3 days then rack onto gelatin finings.

Condition at 55.0 F for 7 days until bright, then package.





# STONE<sup>®</sup> IPA

India Pale Ale

6.9% Alc. Vol.

12 Fl. Oz.

NORTH COUNTY SAN DIEGO

# Stone IPA - A Review

Stone IPA

Stone Brewing Company, Escondido, CA

Stone IPA isn't just a classic beer, it's one of the progenitors of the West Coast IPA style. Centennial, Chinook and Columbus hops lay down an impressive interplay of citrus and pine aromatics forward of a medium light crystal malt, which also helps color the beer a full, brilliant orange-gold. Hop flavor is almost as intense as aroma, thanks to extended post-boil contact time to extract maximum hop oil. There is almost a floral rose flavor that emerges from these oils, coupled with some volatiles from the 6.9% ABV. Finishes with a long trail of near-aggressive bitterness.

# Stone IPA - Sensory Evaluation

## Appearance

Color - crystal clear orange-gold (3.5 SRM)

- Thick white foam, great retention: all-malt, no adjuncts.
- Malt: No colored malts. 90% pale two-row, 10% 20L crystal?

Clarity - Very good, no sediment. Filtered or centrifuged?

Carbonation - medium to medium-high, (2.5 vol?); fine, lasting bubbles.

# Stone IPA - Sensory Evaluation

## Aromatics

Malt - Pale two-row, some light caramel malt, mostly hidden by hop aromatics. Caramel may be UK sourced; slight biscuit note.

Hops - Big aromatic punch of citrus (grapefruit and lemon peel) and pine; nothing tropical; classic C hop profile of Centennial. Columbus adds a bit of earthy, woody character.

Little of the abrasive pine sap character of Chinook; It's there, but I'm guessing the late and dry hop proportion of Chinook is lower. Based on aromatics, there is probably a whirlpool and dry hop addition.

Yeast - Clean ale yeast, possibly American/Chico strain

## Stone IPA - Sensory Evaluation

### Flavor

Malt (palate) - Any malt sweetness from caramel malt is soon overwhelmed by hop bitterness.

Malt (olfactory) - There is a slight biscuit note to the light caramel - UK sourced, perhaps?

Hops (palate): Profound but not acrid or cutting bitterness; some astringency.

Hops (olfactory): Mainly citrus; some pine; floral, rose-like notes mid-palate—yeast ester or hop oils?

Other (palate): Carbonation is moderate, but emphasizes bitterness.

## Stone IPA - Sensory Evaluation

**Palate weight/dryness:** Dry. Thorough attenuation is critical to achieve forceful hop bitterness without jagged edges.

Hop oils continue strongly through finish, but there is some residual malt sweetness to partially balance.

**Carbonation:** light carbonic acid contribution; enhances hop aftertaste and perception of bitterness/astringency.

**Alcohol:** Very little heat or volatility apparent until aftertaste.

**Water:** Relatively soft water, perhaps with calcium sulfate to accentuate kettle hop bitterness; no saltiness or savory aftertaste.

## Clone Techniques Seminar – Best-Guess Recipe for Stone IPA

American IPA (14 B)

Est Original Gravity: 1.065 SG

Est Final Gravity: 1.010 SG

Estimated Alcohol by Vol: 6.9 %

Bitterness: 77 IBUs

Est Color: 6 SRM

Mash: Single Infusion, Light Body, No Mash Out

Sparge Water: 5.93 gal

Sparge Temperature: 168.0 F

Water: Reverse Osmosis treated with 1g/gallon calcium sulfate

Batch Size: 5.50 gal

Boil Time: 90 min

Efficiency: 75.00 %

### Ingredients

12 lbs 4.0 oz pale 2-row malt, US (2.0 SRM) 93.3 %

14.0 oz 15L crystal malt, UK (15.0 SRM) 6.7 %

0.25 oz Chinook, pellets [13.00 %] - Boil 60.0 min, 9.5 IBUs

1.25 oz Centennial, whole [10.00 %] - Boil 10.0 min, 12.0 IBUs

1.25 oz Columbus, whole [14.00 %] - Boil 10.0 min, 16.8 IBUs

2.00 oz Centennial, whole [10.00 %] - Steep/Whirlpool 20.0 min, 16.1 IBUs

2.00 oz Columbus, whole [14.00 %] - Steep/Whirlpool 20.0 min, 22.5 IBUs

Dry English Ale (White Labs #WLP007), 1L starter

1.00 oz Centennial, whole [10.00 %] - Dry Hop 5 Days, 0.0 IBUs

1.00 oz Columbus, whole [14.00 %] - Dry Hop 5 Days, 0.0 IBUs

Mash PH: 5.20

Mash at 149 F for 75 minutes.

Sparge: Fly sparge with 7.24 gal water at 168.0 F.

Ferment at 67.0 F for 5-7 days or until yeast drops.

Dry Hop at 67.0 F for 5 days then rack onto gelatin finings.

Condition at 55.0 F for 7 days until bright, then package.

Thanks again to Mitch and Jamil for attending and contributing beer samples for this seminar.

Extra copies of “clone” recipes are available.

Please email me at [amahl@brewersassociation.org](mailto:amahl@brewersassociation.org) if you would like a copy of this presentation.

Questions?