COLD HOPS, HOT MARGINS

How to Use Cryogenic Lupulin Pellets to Brew More Efficiently

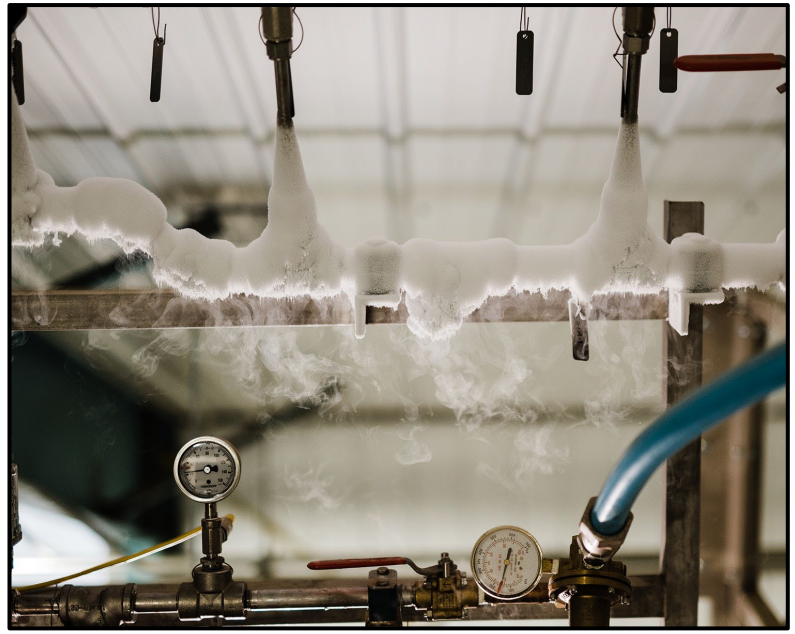
CROSBY HOPS™

AGENDA

- What are Cryogenic Lupulin Pellets?
- How are they made and why are they beneficial?
- Free hops! How using Cryogenic Lupulin Pellets with T-90s can pay off
- Case studies: Real results from some of the world's best breweries

What are Cryogenic Lupulin Pellets?

- **Ultra-concentrated hop pellets packed with resins and oils**
- **Lupulin glands separated from rest of hop cone using liquid nitrogen extraction**
- **Double the potency of traditional T-90 pellets**
- **100% pure hops with no additives**



Why Use Cryogenic Lupulin Pellets?

Increase Brewing Yield

Reduce Shipping & Storage Costs

Reduce Environmental Impact

Increase Revenue per Batch

Decrease Hop Creep

Amplify Flavor & Aroma

“Utilizing cryogenically produced concentrated hop pellets to subsidize a T90 pellet charge is a known opportunity to ***increase yield***, especially in a dry hop or whirlpool application. The beneficial opportunities transcend the increased beer recovery by providing an ***improved overall hop impression***, ***improved clarification***, ***decreased turbidity*** *and* ***DO pickup***, and of course the ***improvements in logistics, storage*** and the ergonomics challenge that come with the high hopping rates that Bell’s employs with Two Hearted.”

- Alec Mull, General Manager, Bell’s Brewery

Cryogenic Lupulin VS. T-45 Pellets

Key Attributes	Cryogenic Lupulin Pellet (CLP)	T-45 Pellet	Key CLP Advantages for Brewers
Oxidation	• Liquid nitrogen processing at extremely cold temperatures • Minimal oxygen contact	• Generally higher processing temperatures • Often exposes hops to oxygen-rich environment = oxidation • Volatile key flavor and aroma compounds	• **Truer, brighter aromas and flavors** • **Longer shelf life**
Potency	• True 2X concentration vs. T-90 • Efficient and consistent separation process	• Usually falls short of true T-45 potency • Mechanical refrigeration creates preservation limitations	• **Stronger, more consistent potency & flavor from batch to batch**
Texture	• Soft, craft-friendly pellet • Proper compression ratios created for modern brewing techniques	• Hard, dense "old school" pellet • Not ideal for modern craft brewing techniques	• **Rapid dispersion means less waste & more flavor**

Best Uses

Where to Use

- Wherever T-90 pellets or whole cone hops are traditionally used
    - Late-addition kettle
    - Whirlpool
    - Fermentation
    - Dry hopping

How to Use

- In conjunction with T90 pellets and whole cone hops
    - Preserves body and mouthfeel
    - Adds bright hop notes
- Dosing rate: 40-50% of T-90 pellets typically used

CGX® ROI – 5 BARREL BATCH

PARAMETERS	
Average yield:	85%
Total pints:	1,240
Retail price per pint:	$7.50
Wholesale price per pint:	$1.95
Percentage of retail sales:	90%
Weighted average sale price per pint:	$6.95

CGX® ROI – 5 BARREL BATCH

PURE T-90 vs BLENDED COST AT FOUR IMPACT LBS.

T-90 cost per pound:	$12.49
CGX cost per pound:	$28.10
T-90 cost at 4 lbs / barrel:	$249.80
Blended cost (2 lbs T-90, 1 lb CGX*) :	$265.41
Cost differential:	$15.61

*CGX replaces T-90 at a rate of 50%

CGX® ROI – 5 BARREL BATCH

Yield Increase and RO-CGX (Return on CGX)
Blended total hop cost is $265.41

Yield Increase	0%	.25%	.5%	1%	2%	3%	4%	5%	6%
New Pints Gained	0	3.10	6.2	12.4	24.8	37.2	49.6	62	74.4
New Pints value	$0	$21.53	$43.06	$86.12	$172.24	$258.35	$344.47	$430.59	$516.71
Hop Cost differential	-$15.61	-$15.61	-$15.61	-$15.61	-$15.61	-$15.61	-$15.61	-$15.61	-$15.61
Return on CGX	-$15.61	$5.92	$27.45	$70.51	$156.62	$242.74	$328.86	$414.98	$501.10

| BREAK EVEN

| FREE HOPS!

+ Shipping and storage expense reductions of approximately 50%

30 & 100 BARREL BATCHES

Yield Increase and RO-CGX (Return on CGX)

30 BBL - Blended total hop cost is $1,337

Yield Increase	0%	.25%	.5%	1%	2%	3%	4%	5%	6%
Return on CGX	-$15.61	$-1.10	$76.45	$231.57	$541.82	$852.07	$1,162	$1,473	$1,783

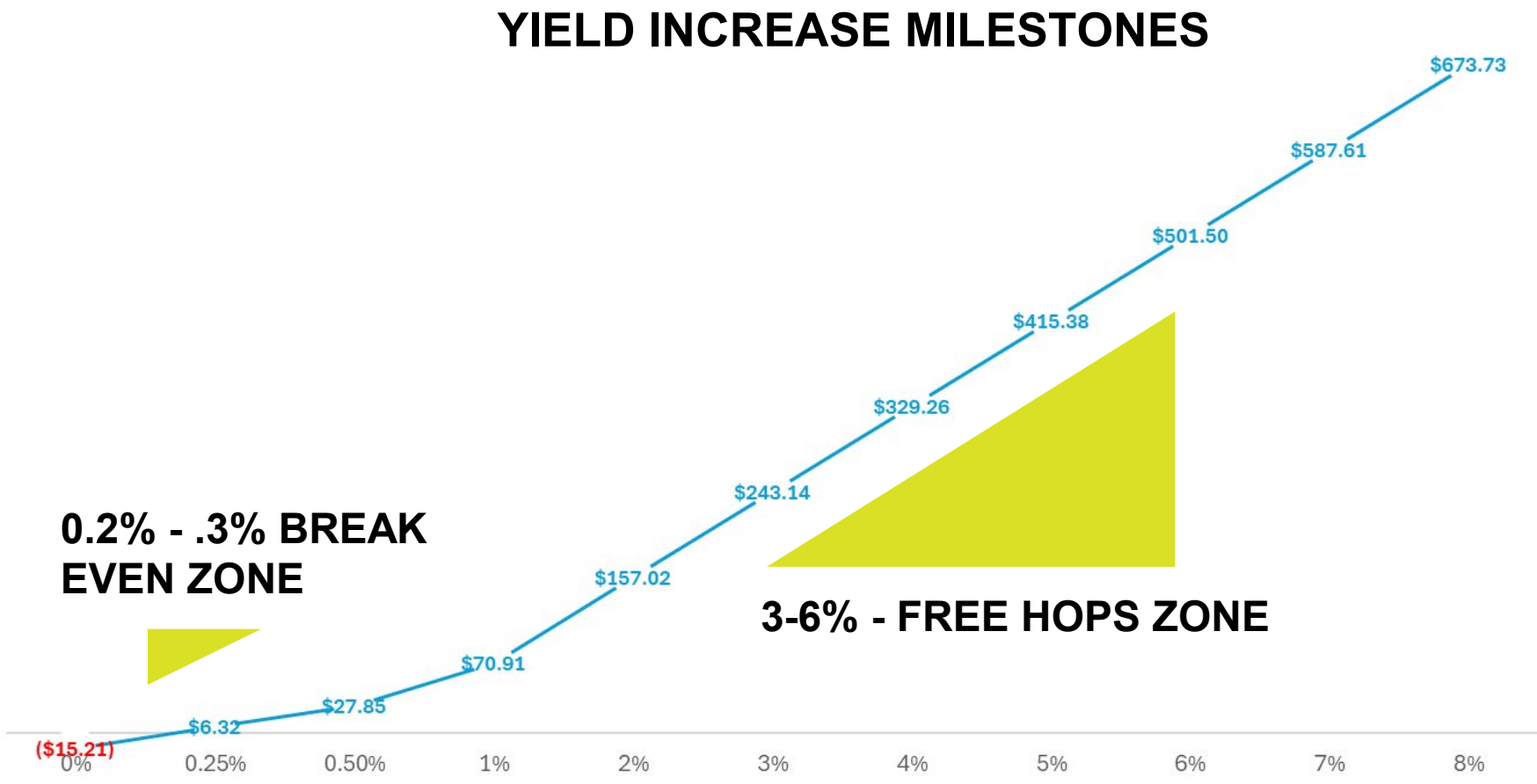
| BREAK EVEN | | | | | | | FREE HOPS! | | |

100 BBL - Blended total hop cost is $4,033

Yield Increase	0%	.25%	.5%	1%	2%	3%	4%	5%	6%
Return on CGX	-$237.25	-$13.12	$211	$659	$1,556	$2,452	$3,349	$4,245	$5,142

| BREAK EVEN | | | | | | | | FREE HOPS! | |

CGX® ROI


YIELD INCREASE MILESTONES
$673.73
$587.61
$501.50
$415.38
$329.26
$243.14
$157.02
$70.91
$27.85
$6.32
($15.21)
0%
0.25%
0.50%
1%
2%
3%
4%
5%
6%
7%
8%
0.2% - .3% BREAK EVEN ZONE
3-6% - FREE HOPS ZONE

CASE STUDIES

How successful breweries use Cryogenic Lupulin Pellets to increase efficiency and maintain quality.

CGX™ CRYOGENIC LUPULIN PELLETS

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CASE STUDY

Mamas Llamas West Coast IPA

How does incorporating **CGX® Cryogenic Lupulin Pellets** in a production beer recipe influence finished beer yield compared to a 100% T-90 version of the same recipe?

By the Numbers

T-90 Only - 15 barrels

- 33lbs Cascade T-90
- 22 lbs Estate Grown™ Comet T-90
- 33 lbs Strata® (an Indie Hops Variety) T-90
- **88 lbs. / 88 impact lbs.**

CGX® + T-90 - 15 barrels

- 11 lbs Cascade T-90
- 11 lbs Estate Grown™ Comet T-90
- 11 lbs Strata® (an Indie Hops Variety) T-90
- **11 lbs Cascade CGX®**
- **11 lbs Estate Grown™ Comet CGX®**
- **11 lbs Strata® (an Indie Hops Variety) CGX®**
- **66 lbs / 99 Impact lbs.**

Key Discoveries

15 barrels – T-90 only

- Yield (bbl) = 12.7
- Yield % = 84.7%
- pH increase after 60 days = .35

15 barrels – CGX® + T-90

- Yield (bbl) = 13.8
- Yield % = 92.0%
- pH increase after 60 days = .19

	Barrel Yield	Batch Efficiency	Batch Retail Value	Hop Cost	
T-90 Only	12.7	84.7%	$20,777	$960	
T-90 + CGX®	13.8	92.0%	$22,577	$1,200	**Profit Increase**
Result	+1.1	+8.7%*	$1,800	-$240	**$1,560**

Applying this approach, **a similarly sized brewery could improve gross profit by $123,000 per year****

Batch Efficiency Difference = +7.3%** (92% batch efficiency vs 84.7% batch efficiency)*

***Assumes 79 batches per year (roughly half the production of a 2k bbl brewery that typically yields 84.7%)*

CGX™ CRYOGENIC LUPULIN PELLETS

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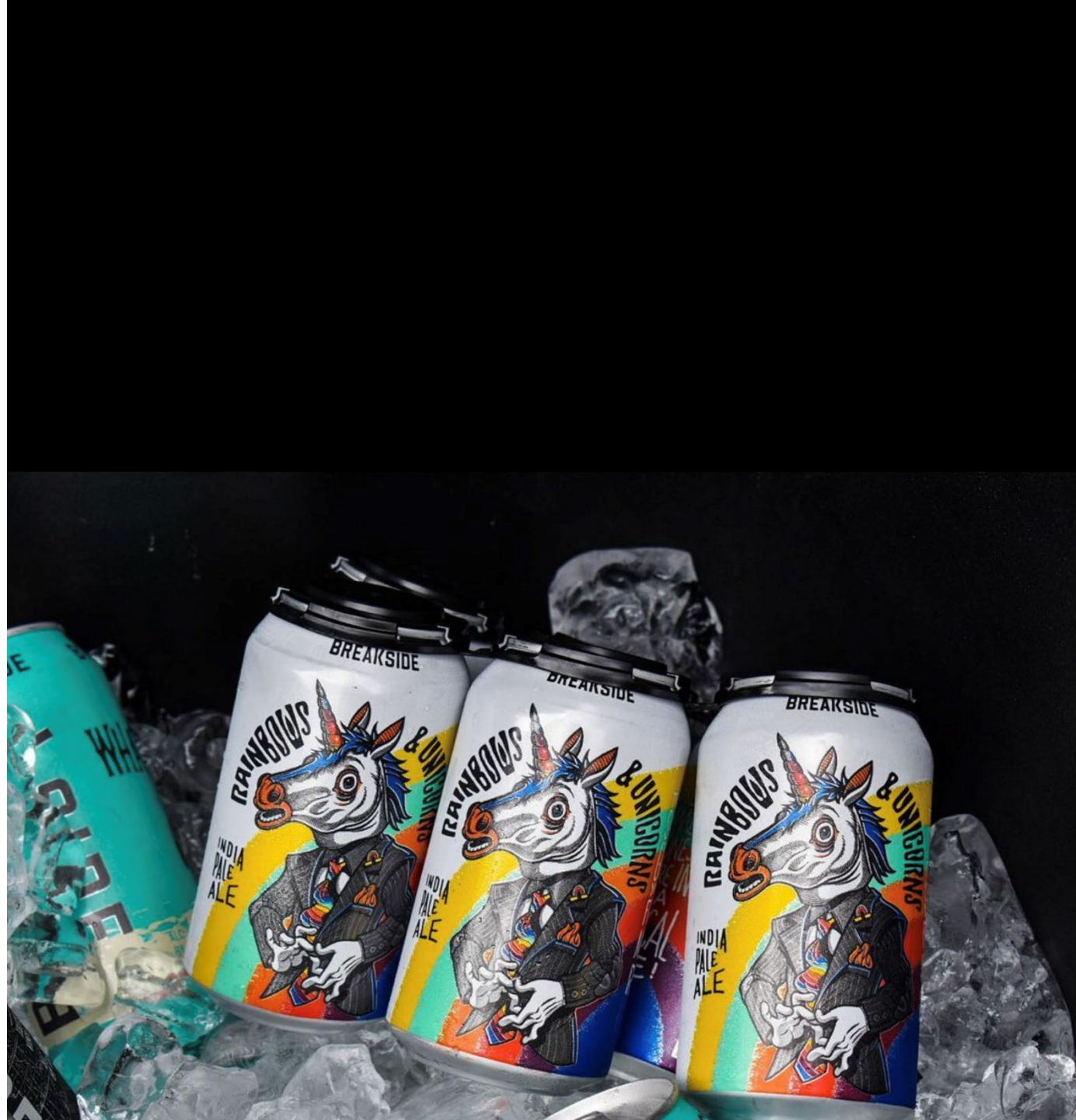
CASE STUDY

Rainbows & Unicorns Session IPA

How does incorporating **CGX Cryogenic Lupulin Pellets** in a production beer recipe influence the below measurables compared to a 100% T-90 version of the same recipe?

- **Finished beer yield**
- **Beer stability**
- **Overall sensory impact**



By the Numbers

Batch Size

- 120 Barrels

T-90 to CGX® ratio by weight

- Whirlpool: 80% T-90 | 20% CGX
- Dry-hop: 78% T-90 | 22% CGX

T-90 to CGX® ratio by impact pounds

- Whirlpool: 67% T-90 | 33% CGX
- Dry-hop: 64% T-90 | 36% CGX

Hop varieties

- El Dorado T-90
- Strata T-90
- El Dorado **CGX®**
- Strata **CGX®**

Key Discoveries

- **3% increase in finished beer yield**
  - In less refined operations, CGX has the potential to increase yields more significantly in hop-forward beers
- **Lower FAN levels in finished beer**
  - Greater stability and consistent flavor during storage
- **High initial flavor and aroma intensity scores**
  - Aroma intensity scores were above average for the first 20–30 days compared to 100% T-90 versions

CGX™ CRYOGENIC LUPULIN PELLETS

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WESTBOUND & DOWN

CASE STUDY

How the West was One: Strata® CGX® Single Hops West Coast IPA

How does incorporating **CGX Cryogenic Lupulin Pellets** in a production beer recipe affect post dry-hop pH?

By the Numbers

Batch Size

- 25 Barrels

Hop varieties

- Batch one: 100% Strata® T-90
- Batch two: Strata® **CGX®** and Strata® T-90

Impact Pounds Ratio

- Strata® **CGX®** was treated as having 1.5x the impact of T-90 pellets, or 25% of the overall hop bill
    - This multiplier was used in both whirlpool and dry hop applications

Key Discoveries

Strata® CGX vs. Strata® T-90 pH comparison

- CGX caused a .17 pH rise from pre to post dry hop
- T-90 caused a .27 pH rise from pre to post dry hop

Finished beer yield

- Increased by 4.8%
- Squarely in the Free Hops Zone

The hypothesis that less vegetal matter decreases post dry-hop pH was accurate. Yields were also higher due to more efficient wort recovery between whirlpool and fermentation vessels, as well as the lower overall dry-hop load.

CONCLUSION

Cryogenic Lupulin Pellets help breweries operate more efficiently and earn higher margins on their beer by increasing their per-batch yield.

They also amplify flavor and aroma while enhancing beer stability by introducing less plant material and more lupulin to the brewing process.

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