

# Alpha, Aroma and a Sprinkling of Both



The US hop industry has long been synonymous with high alpha production. Certain varieties of hops are champs in the production of high levels of alpha acid, and the resulting hop extract provides brewers worldwide with this important bittering component. US growers also produce an array of fine aroma hops that allow brewers to customize the profile of each unique beer. However, many of the interesting aroma-type hops that have been developed and grown in the US for decades have found popularity with brewers who are looking for distinctive flavors and aromas, around which a dizzying array of beer styles and specialty brews can be developed. Many of these hops also contain respectable amounts of alpha acid, and can serve as dual-purpose superstars in the brewing process.

## #1 CRAFT VARIETY!

### CASCADE

Cascade is an aroma hop that was developed by the USDA breeding program in Corvallis, Oregon and released in 1972. It has a medium strength aroma and provides a unique aroma profile with citrus, grapefruit, floral, and spicy notes, along with well-balanced bittering potential. It is the most popular hop with the US craft brewing industry, and has long been used by major brewers to provide unique flavor and aroma profiles. Cascade is currently one of the fastest growing US hop varieties, with new acreage being established each year to meet growing demand.



### HISTORY

In 1968, Charles E. Zimmermann, USDA hop research scientist, developed a new hop variety in Oregon, code named 56013. He thought this new hop could be a strong US competitor to European aroma hops and had the potential to expand the US varieties available to breweries. At the time, US breweries sourced aroma hops from Europe.

The variety was released 4 years later, and it required several more years before brewers embraced Cascades. The rest is history. For over 35 years, Cascades have played a vital role with large breweries and have provided the iconic flavor for American craft beers.

Yield (kilos per hectare)	1,792-2,240	Myrcene*	45-60%
Yield (lbs. per acre)	1,600-2,000	Caryophyllene*	3.5-5.5%
Alpha acids	4.5-7.0%	Humulene*	8.0-13.0%
Beta acids	4.8-7.0%	Farnesene*	3.0-7.0%
Cohumulone†	33-40%	Storage**	48-52%
Total oils	0.7-1.4 Mls. per 100g dried hops		

**CITRUS**  
**FLORAL**  
**GRAPEFRUIT SPICY**





# CHINOOK

Chinook was developed by the USDA breeding program in Washington State and released in 1985 as a high alpha variety. It has a highly acceptable beer aroma profile with smooth bitterness and full flavor.

Yield (kilos per hectare)	1,904-2,352	Myrcene*	35-40%
Yield (lbs. per acre)	1,700-2,100	Caryophyllene*	9.0-11.0%
Alpha acids	12-14%	Humulene*	18-23%
Beta acids	3.0-4.0%	Farnesene*	<1.0%
Cohumulone†	29-35%	Storage**	68%
Total oils	1.7-2.7 Mls. per 100g dried hops		

**PINE** **SPICY**  
**MEDIUM** **INTENSE**  
**DISTINCTIVE**  
**GRAPEFRUIT**

# CENTENNIAL

Centennial is an aroma variety that was released by Washington State University in 1990. It was derived from three-quarters Brewer's Gold with minor contributors from Fuggle, East Kent Golding and others. It is among the most popular varieties for US craft brewers and is sometimes referred to as a super Cascade.

**MEDIUM** **CITRUS**  
**INTENSE**  
**FLORAL**

Yield (kilos per hectare)	1,700-2,000	Myrcene*	45-55%
Yield (lbs. per acre)	1,500-1,750	Caryophyllene*	5.0-8.0%
Alpha acids	9.5-11.5%	Humulene*	10-18%
Beta acids	3.5-4.5%	Farnesene*	<1%
Cohumulone†	29-30%	Storage**	60-65%
Total oils	1.5-2.5 Mls. per 100g dried hops		

# CRYSTAL

Crystal is a triploid variety that was bred by USDA from Hallertau mf, Cascade, Northern Brewer, and Early Green. It is perceived as the most pungent of the triploid Hallertau family of hops, and is increasingly popular among US craft brewers. It is a versatile variety that is used in Pilsners and Lagers, as well as ESBs and American and Belgian-style Ales.

**MILD** **SPICY**  
**FLORAL**

Yield (kilos per hectare)	1,350-2,250	Myrcene*	40-65%
Yield (lbs. per acre)	1,200-2,000	Caryophyllene*	4-8%
Alpha acids	3.5-5.5%	Humulene*	18-24%
Beta acids	4.5-6.5%	Farnesene*	<1%
Cohumulone†	20-26%	Storage**	50%
Total oils	1.0-1.5 Mls. per 100g dried hops		



## CTZ

Columbus, Tomahawk®, and Zeus are often grouped together and labeled as CTZ. They are referred to as Super High Alpha varieties, having alpha acid content of between 14.5-16.5%.

**CITRUS**  
**FENNEL**  
**ANISEED** **NETTLE**

Yield (kilos per hectare)	2,800-3,249	Myrcene*	40-50%
Yield (lbs. per acre)	2,500-2,900	Caryophyllene*	9-11%
Alpha acids	14.5-16.5%	Humulene*	12-18%
Beta acids	4.0-5.0%	Farnesene*	<1%
Cohumulone†	28-32%	Storage**	52%
Total oils	2.0-3.0 Mls. per 100g dried hops		

## TRIPLE PEARL

TriplePearl is a triploid daughter of Perle that was released by USDA-ARS in late 2013. Pleasant, mellow aroma with notes of orange-citrus, orange rind/zest, melon, resin, spicy, and slight pepper.

**ORANGE RIND/ZEST** **RESIN**  
**ORANGE-CITRUS**  
**SPICY** **MELON** **PEPPER**

Yield (kilos per hectare)	1,600-1,650	Myrcene*	39.3-55%
Yield (lbs. per acre)	1,800-1,900	Caryophyllene*	3.5-5.1%
Alpha acids	10.25-11.2%	Humulene*	7.7-10.4%
Beta acids	3.3-4.2%	Farnesene*	.3-.6%
Cohumulone†	21.8-24.9%	Storage**	—
Total oils	1.1-1.79 Mls. per 100g dried hops		



## CASHMERE

Cashmere was released by Washington State University in 2013. A daughter of Cascade, it includes Northern Brewer germplasm through the male parent. The alpha acid content of Cashmere is higher than Cascade. Cashmere contains no farnesene and twice as much humulene as Cascade. Cashmere's aroma has strong melon, fruity (lemon, lime peel, pineapple), coconut, and spicy notes. It is unique, pleasant, complex, and powerful.

Yield (kilos per hectare)	2,000-2,200	Myrcene*	39-42%
Yield (lbs. per acre)	1,800-2,000	Caryophyllene*	11.5-13%
Alpha acids	7.7-9.1%	Humulene*	26-29%
Beta acids	6.4-7.1%	Farnesene*	<1%
Cohumulone†	22-24%	Storage**	75%
Total oils	1.2-1.4 Mls. per 100g dried hops		

**FRUITY** **COCONUT** **LEMON**  
**MELON**  
**SPICY** **LIME PEEL** **PINEAPPLE**





# WILLAMETTE

Named after Oregon's Willamette River, which runs through the state's hop growing region, Willamette was released in 1976 from the USDA breeding program. It is a daughter of the classic English variety, Fuggle, and is characterized by a low alpha content and mild aroma. Willamette is the most widely grown US aroma hop. It imparts a mild, slightly spicy, and pleasant aroma in beer.

Yield (kilos per hectare)	1,500-1,900	Myrcene*	30-40%
Yield (lbs. per acre)	1,300-1,700	Caryophyllene*	6.5-8.2%
Alpha acids	4.0-6.0%	Humulene*	20-27%
Beta acids	3.5-4.5%	Farnesene*	5.0-6.0%
Cohumulone†	30-35%	Storage**	60-65%
Total oils	1.0-1.5 Mls. per 100g dried hops		

CURRY **INCENSE**  
**CITRUS**  
 CARAMEL ELDERBERRY

## TAHOMA

Tahoma was released by Washington State University in 2013. Tahoma is a daughter of Glacier that retains the very low cohumulone characteristic of Glacier with somewhat higher alpha acid content. Pleasant aroma with predominate citrus (lemon, slight grapefruit), along with cedar wood, pine, and spicy notes. It's considered Cascade-like.

LEMON GRAPEFRUIT  
**CITRUS**  
 CEDAR PINE SPICY

Yield (kilos per hectare)	2,000-2,200	Myrcene*	67-72%
Yield (lbs. per acre)	1,800-2,000	Caryophyllene*	2.9-3.5%
Alpha acids	7.2-8.2%	Humulene*	9-11%
Beta acids	8.5-9.5%	Farnesene*	<1%
Cohumulone†	15-17%	Storage**	75%
Total oils	1-2 Mls. per 100g dried hops		

## YAKIMA GOLD

Yakima Gold was released by Washington State University in 2013. Yakima Gold, from a cross between Early Cluster and a native Slovenian male, is an excellent general purpose hop with smooth bitterness and a pleasant aroma.

LEMON ZEST  
**GRAPEFRUIT**  
 LEMONGRASS SPICY

Yield (kilos per hectare)	2,000-2,200	Myrcene*	45-50%
Yield (lbs. per acre)	1,800-2,000	Caryophyllene*	6.4-8.0%
Alpha acids	8.8-10.5%	Humulene*	21-25%
Beta acids	4.3-5.0%	Farnesene*	9-10%
Cohumulone†	21-23%	Storage**	85%
Total oils	1.9-2.3 Mls. per 100g dried hops		

\*As % of total oils \*\*% alpha acids remaining after 6 months storage at 20° C



# US Hop Variety Snapshot

VARIETY	ALPHA/BETA	COHUM	OILS*	AROMA
AHATANUM™	5.7 - 6.3 / 5.0 - 6.5 %	30 - 35 %	0.8 - 1.2	FLORAL, EARTHY, CITRUS, GRAPEFRUIT
AMARILLO®	8.0 - 11.0 / 6.0 - 7.0 %	21 - 24 %	1.5 - 1.9	BLACK TEA, LEMON, PEACH, MELON, APRICOT, GRAPEFRUIT
APOLLO	15.0-19.0 / 5.5-8.0 %	24 - 28 %	1.5 - 2.5	AROMATIC, PLEASANT, GRAPEFRUIT
BITTER GOLD	15.5-18.8 / 6.1-8.0 %	36 - 41 %	0.8 - 3.9	FRUITY, TROPICAL, CITRUS, FRESH CUT GRASS
BRAVO	14.0-17.0 / 3.0-5.0 %	29 - 34 %	1.6 - 2.4	PLEASANT, FRUITY, FLORAL
BREWER'S GOLD (US)	8.0-10.0 / 3.5-4.5 %	40 - 48 %	2.0 - 2.4	BLACKCURRANT, FRUITY, SPICY
BULLION	6.7 - 12.9 / 3.7 - 9.1 %	~39 %	1.1 - 2.7	ZESTY BLACKCURRANT
CASCADE	4.5 - 7.0 / 4.8 - 7.0 %	33 - 40 %	0.7 - 1.4	FLORAL, SPICY, CITRUS, GRAPEFRUIT
CASHMERE	7.7 - 9.1 / 6.4 - 7.1 %	22 - 24 %	1.2 - 1.4	MELON, FRUITY (LEMON, LIME PEEL, PINEAPPLE), COCONUT, SPICY
CALYPSO	12.0-14.0 / 5.0-6.0 %	40 - 42 %	1.6 - 2.5	PLEASANT FRUITY AROMA, PEAR, APPLE
CENTENNIAL	9.5 - 11.5 / 3.5 - 4.5 %	29 - 30 %	1.5 - 2.5	MEDIUM INTENSE, FLORAL, CITRUS
CHELAN	12.0-14.5 / 8.5-9.8 %	33 - 35 %	1.5 - 1.9	PLEASANT CITRUS
CHINOOK	12.0-14.0 / 3.0-4.0 %	29 - 35 %	1.7 - 2.7	MEDIUM INTENSE, SPICY, PINE, DISTINCTIVE GRAPEFRUIT
CITRA®	11.0-13.0 / 3.5-4.5 %	22 - 24 %	2.2 - 2.8	STRONG CITRUS, TROPICAL FRUIT
CLUSTER	5.5 - 8.5 / 4.5 - 5.5 %	37 - 43 %	0.4 - 0.8	FLORAL, SPICY
COLUMBIA	6.8 - 11.5 / 2.9-5.6 %	~40 %	0.5 - 1.6	SUBTLE EARTH, MILD FRUIT
COLUMBUS	14.5-16.5 / 4.0-5.0 %	28 - 32 %	2.0 - 3.0	CITRUS, FENNEL, NETTLE, ANISEED
COMET	9.0 - 11.0 / 4.0 - 6.0 %	38 - 42 %	1.0 - 1.5	GRAPEFRUIT AND CITRUS
CRYSTAL	3.5 - 5.5 / 4.5 - 6.5 %	20 - 26 %	1.0 - 1.5	MILD, SPICY, FLORAL
CTZ	14.5-16.5 / 4.0-5.0 %	28 - 32 %	2.0 - 3.0	CITRUS, FENNEL, NETTLE, ANISEED
DELTA	5.5 - 7.0 / 5.5 - 7.0 %	22 - 24 %	0.5 - 1.1	SLIGHTLY SPICY WITH A HINT OF CITRUS
EL DORADO®	14.0-16.0 / 7.0-8.0 %	23 - 33 %	2.5 - 2.8	TROPICAL FRUIT, PEAR, WATERMELON, STONE FRUIT
EROICA	7.3 - 14.9 / 3.0 - 5.3 %	~40 %	~0.9	FORWARD FRUIT FLAVORS
FIRST GOLD	5.6 - 9.3 / 2.3 - 4.1 %	32 - 34 %	0.7 - 1.5	SPICY, SIMILAR TO GOLDING
FUGGLE (US)	4.0 - 5.5 / 1.5 - 2.0 %	25 - 32 %	0.7 - 1.2	WOODY, FRUITY
GALENA	11.5-13.5 / 7.2-8.7 %	36 - 40 %	0.9 - 1.3	CITRUS, LIME, GOOSEBERRY, BRANDY, PEAR, PINEAPPLE, SPICY
GLACIER	~5.5 / ~8.2 %	11 - 13 %	0.7 - 1.6	PLUM, ARTICHOKE, ELDERFLOWER, VANILLA, BLACKBERRY
GOLDING (US)	4.0 - 6.0 / 2.0 - 3.0 %	23 - 28 %	0.7 - 1.0	MILD, DELICATE, SWEET FLORAL
HALLERTAU (US)	3.5 - 5.5 / 3.5 - 5.5 %	18 - 24 %	0.6 - 1.0	MILD, SPICY, HERBAL, FLORAL
HORIZON	11.0-13.0 / 6.5-8.5 %	16 - 19 %	0.5 - 2.0	FLORAL, SPICY

\*OILS = ML/100G

VARIETY	ALPHA/BETA	COHUM	OILS*	AROMA
LIBERTY	3.0 - 5.0 / 3.0 - 4.0 %	24 - 30 %	0.6 - 1.2	MILD, SLIGHTLY SPICY
MAGNUM (US)	12.0-14.0 / 4.5-6.0 %	24 - 28 %	1.9 - 2.3	NOT DISTINCT
MILLENNIUM	14.5-16.5 / 4.3-5.3 %	28 - 32 %	1.8 - 2.2	STRAWBERRY, ELDERFLOWER, CHOCOLATE, TOFFEE, PEAR
MOSAIC®	11.5-13.5 / 3.2-3.9 %	24 - 26 %	1.0 - 1.5	PEAR, GOOSEBERRY, MANDARIN, LIME, PEACH
MT. HOOD	4.0 - 7.0 / 5.0 - 8.0 %	21 - 23 %	1.2 - 1.7	HONEY, LEMON CAKE, LEMON TEA, TARRAGON, FENNEL
MT. RAINIER	8.0 - 10.8 / 7.6 - 9.3 %	21 - 23 %	1.8 - 2.7	FLORAL AND NOBLE AROMA, CITRUS AND LICORICE
NEWPORT	13.5-17.0 / 7.2-9.1 %	36 - 38 %	1.6 - 3.4	MILD
NORTHERN BREWER (US)	8.0-10.0 / 3.0-5.0 %	20 - 30 %	1.5 - 2.0	MEDIUM INTENSITY, PINE, MINT
NUGGET	11.5-14.0 / 4.2-5.8 %	22 - 26 %	1.8 - 2.2	LIME, GINGER, PINEAPPLE, GERANIUM, LYCHEE
OLYMPIC	10.6-13.8 / 3.8-6.1 %	~31 %	0.8 - 2.5	CITRUS, SUBTLE SPICE
PALISADE®	5.5 - 9.5 / 6.0 - 8.0 %	24 - 29 %	1.4 - 1.6	ORANGE, APRICOT, PASSION FRUIT, HONEY, YOGURT
PERLE (US)	7.0 - 9.5 / 4.0 - 5.0 %	27 - 32 %	0.7 - 0.9	SLIGHTLY SPICY, HERBAL, FLORAL
SAAZ (US)	3.0 - 4.5 / 3.0 - 4.5 %	24 - 28 %	0.5 - 1.0	MILD SPICE, EARTH
SANTIAM	5.0 - 7.0 / 6.0 - 8.0 %	22 - 24 %	1.3 - 1.5	HERBAL, NOBLE HOP AROMA
SIMCOE®	12.0-14.0 / 4.0-5.0 %	15 - 20 %	2.0 - 2.5	UNIQUE PINE-LIKE AROMA
SORACHI ACE	12.0-13.0 / 8.8-9.9 %	23 - 27 %	2.8 - 3.2	UNIQUE LEMON AND DILL
STERLING	6.0 - 9.0 / 4.0 - 6.0 %	22 - 28 %	1.3 - 1.9	HERBAL, SPICY, HINT OF FLORAL, CITRUS
SUMMIT®	16.0-18.0 / 4.0-6.0 %	26 - 33 %	1.5 - 2.5	PEPPER, GOOSEBERRY, WILD GARLIC, INCENSE, ANISEED
SUPER GALENA	13.0-16.0 / 8.0-10 %	35 - 40 %	1.5 - 2.5	CITRUS, SIMILAR TO GALENA
TAHOMA	7.2 - 8.2 / 8.5 - 9.5 %	15 - 17 %	1.0 - 2.0	CITRUS (LEMON, SLIGHT GRAPEFRUIT), CEDAR WOOD, PINE, SPICY
TETTNANG (US)	4.0 - 5.0 / 3.0 - 4.0 %	20 - 25 %	0.4 - 0.8	MILD, SLIGHTLY SPICY
TOMAHAWK	14.5-16.5 / 4.0-5.0 %	28 - 32 %	2.0 - 3.0	CITRUS, FENNEL, NETTLE, ANISEED
TRIPLEPEARL	10.2-11.2 / 3.3-4.2 %	22 - 25 %	1.1 - 1.8	ORANGE-CITRUS, ORANGE RIND/ZEST, MELON, RESIN, SPICY, SLIGHT PEPPER
ULTRA	2.0 - 3.5 / 3.0 - 4.5 %	23 - 38 %	0.5 - 1.0	MILD, PLEASANT, SAAZ-LIKE
VANGUARD	5.5 - 6.0 / 6.0 - 7.0 %	14 - 16 %	0.9 - 1.2	MILD, PLEASANT, SIMILAR TO HALLERTAU MITTELFUEH
WARRIOR®	15.0-18.0 / 4.3-5.3 %	22 - 26 %	1.3 - 1.7	VERY MILD
WILLAMETTE	4.0 - 6.0 / 3.5 - 4.5 %	30 - 35 %	1.0 - 1.5	CITRUS, INCENSE, ELDERBERRY, CARAMEL, CURRY
YAKIMA GOLD	8.8-10.5 / 4.3 - 5.0 %	21 - 23 %	1.9 - 2.3	GRAPEFRUIT, LEMON ZEST, LEMONGRASS, SLIGHTLY SPICY
ZEUS	12.0-16.5 / 4.0-6.0 %	27 - 35 %	1.0 - 2.0	AROMATIC, PLEASANT

FOR DETAILED VARIETY LISTINGS: [USAHOPS.COM](http://USAHOPS.COM)