

Hops Companion

A brewer's guide to hop varieties
and hop products

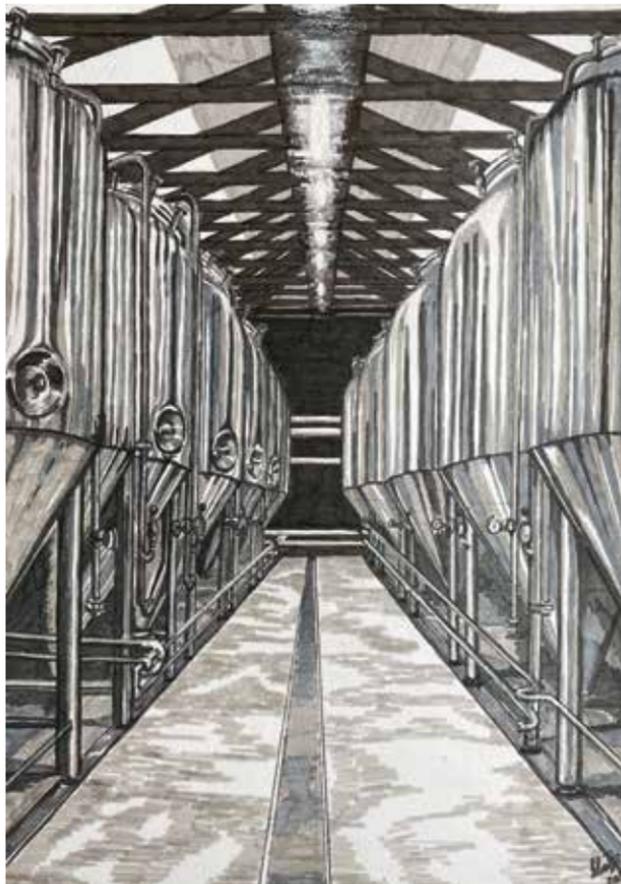


HAAS

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HIPA



Hops Companion

A brewer's guide to hop varieties
and hop products

FOURTH EDITION

Hops Companion

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Welcome to the Fourth Edition of the *Hops Companion*!

With Tim Kostelecky's retirement from John I. Haas, Inc., (HAAS®) I have assumed the editorial duties for the Fourth Edition of the guide. Tim has done an exemplary job in creating and shepherding the *Hops Companion* through the three previous editions. I can only hope to emulate Tim's efforts and will strive to maintain the same quality standards that he has set and maintained over the years.

Overall, the goal for the *Hops Companion* remains the same, to provide an easy to use reference guide for hop varieties from around the world. The design of the hop variety pages allows the reader to obtain desired information quickly at a glance. This includes short background descriptions outlining information such as pedigree and flavor characteristics. Hopsessed® aroma icons depict pictorial representations of key hop flavor attributes. In addition, each hop variety page contains a table containing specific bitterness and aroma chemical data.

Each edition of the *Hops Companion* has reflected the changing landscape of the world of hops. Breeding programs have striven to produce hops with flavor profiles that are unique and impactful to meet the needs of a changing beer market. This has resulted in the proliferation of new varieties and the decrease in demand for some legacy hops. Given the limitations of space, not all hop varieties could be included in the *Hops Companion*. Judgement calls based on commercial



appeal or historical significance determined whether a variety was included into this Guide. Certainly, if there is a groundswell of support for an excluded variety, it will be included in the Fifth Edition!

The use of hops in beer is as much an art as it is a science. In recognition of this thought, the title page leads off the *Hops Companion* with a lovely painting of a brewery scene. Thanks go out to my BarthHaas® colleague—Dr. Christina Schönberger—for contributing her creative flair to the book.

Certainly, this edition of the *Hops Companion* could not have come to fruition without the assistance of my valued colleagues. Tim Kostelecky was very helpful in answering my many questions and as a resource for varietal page content. I also want to express my appreciation to Jeff Dailey, Sydney Masovero, Brian Buffin, Jim Ringo and Corrie Van Oostrum for their eagle eyes and their many helpful suggestions. Kudos go out to Renee Bolz, Rob Waldeck, Meredith McKelvey, and Kate Graceffo from Holland-Mark for all of the great work that they did in bringing the Companion to a publication ready format.



Cheers and happy brewing!

Phil Chou, Director of
Brewing Solutions

John I. Haas, Inc.

Yakima, Washington USA



Hops and Hop Products

Hops have been a primary ingredient in beer since medieval times. These plant products contribute to key properties such as aroma, taste, bitterness, foam, and shelf life. Leveraging this versatility has enabled brewers to evolve their approaches to using hops. Historically, hops served as a complementary spice and preservative. The craft beer movement, however, ushered in an era of bold, exciting flavors that have captured the hearts and minds of brewers and beer drinkers. In fact, this movement produced titanic shifts in the beer flavor landscape, with hops at the forefront. Brewers are increasingly creative in the use of hops in their recipes in existing beer styles, while also developing new hop-centric beers such as New England India Pale Ales. This heightened interest in flavor even extends to the farm. Hop “aroma” varieties have supplanted bitter cultivars as the majority of planted acreage. In parallel, hop breeding programs are developing new varieties to meet the demand for unique and bold flavor profiles. Further shifts in the craft beer landscape will continue to be driven by brewers, hop breeders, as well as consumers.

Brewers often refer to their “spice rack” of ingredients that allows them to create the flavor profiles they seek in crafting their beers. Among the most important components in this spice rack are hops and hop-derived products—these are key contributors to the pleasurable sensory experience that we derive from beer.



From a botanical perspective, hops have several interesting characteristics. The plant is a perennial climbing bine and grows as separate male and female plants (dioecious). Male plants have no applications in brewing; their primary value is to provide genetic material during the breeding of new hop varieties. Brewing value derives from the cones from the female plant. The cone contains lupulin glands that produce hop resins, which impart the bitterness, aroma, and tastes that brewers seek.



From a brewing perspective, the lupulin glands supply many of the most valued flavor compounds. These glands produce two types of resins. Soft resins are those that are soluble in low boiling hydrocarbon solvents such as hexanes. Hard resins contain compounds that are not soluble in hexanes but are dissolved by more polar solvents such as methanol. One can think of the soft resins as hop “gold mines” where much of the brewing value of hops lies. The compounds most identified with hop flavor—alpha acids and essential oils—are soft resin components. Beta acids are another component of soft resins. These compounds have little inherent brewing value, but have applications in other industries. Hard resins contain chemicals that are associated with alpha and beta acid oxidation products as well as other notable compounds, such as polyphenols and xanthohumol.

Historically, hops were classified as either bitter or aroma varieties. Bittering hops have high alpha acid concentrations and brewers primarily use them early during kettle boil. Aroma hops have low alpha acid levels with essential oil profiles that produce desirable aroma in beer. These distinctions began to blur as hop breeding programs introduced many new hops that possessed both high alpha acids and pleasing aroma. This prompted the proposal of a new hop category: dual-purpose hops. Nonetheless, such narrowly defined hop designations may not best describe individual varieties given the increasingly creative ways in which brewers use hops.



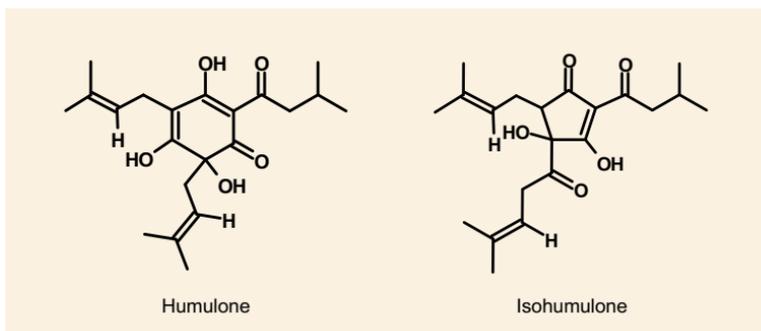
In fact, even the form in which brewers use hops has shifted. The earliest application of hops to brewing required the whole or hop cone form. Ultimately, this approach is relatively inefficient to deliver bitterness, aroma, and flavor to beer. Brewers' needs therefore prompted the development of a wide variety of hop products, ranging from pre-isomerized pellets to essential oil extracts. Hop products can have specialized or more general applications in the brewing process. For example, brewers primarily use hop extracts in the kettle to impart bitterness. In comparison, pellets find applications in the brewhouse for bitterness, as well as in cold side dry-hopping operations for aroma and taste. All of these forms and uses illustrate the versatility that hops have as a brewing ingredient.

HOP CHEMISTRY

Bittering Compounds

Alpha acids such as humulone provide the primary source for bitterness in beer. However, alpha acids have limited solubility and contribute little bitterness without a key conversion step. During kettle boil, alpha acids undergo isomerization to isoalpha acids, such as isohumulone, that produce the majority of hop-derived bitterness. Hop products are also available that contain pre-isomerized alpha acids such as isopellets and isomerized kettle extract (IKE). Thus, brewers have options as to how they choose to impart bitterness to their beers.





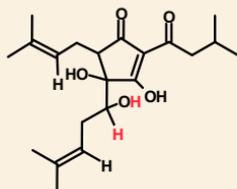
The most abundant alpha acid in hops is humulone (35–70% of total alpha acids). Other alpha acid components are cohumulone (20–65%), adhumulone (10–15%), prehumulone (1–10%), and posthumulone (1–3%). Humulone and cohumulone are regarded as the key alpha acids in brewing.

Each of these alpha acids are distinct chemical compounds and have the potential to yield different sensorial perceptions of bitterness. Traditionally, brewers have considered the quality of bitterness derived from isomerized humulone (isohumulone) to be superior to that of isomerized cohumulone (isocohumulone). As a consequence, brewers have sought hops that possess low levels of cohumulone. However, there is compelling evidence in the scientific literature that indicates that isocohumulone does not impart undesirable bitterness to beer.

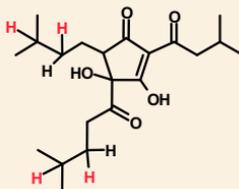
Brewers also use post-brewhouse advanced or downstream hop products to impart bitterness to beer. These include *rho*-isoalpha acids, tetrahydroisoalpha acids, and



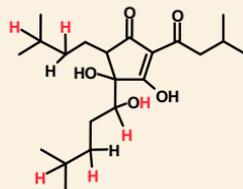
hexahydroisoalpha acids. Compounds such as oxidized alpha and beta acids and polyphenols (tannins) can also impact bitterness perception in beer.



Rho-isohumulone



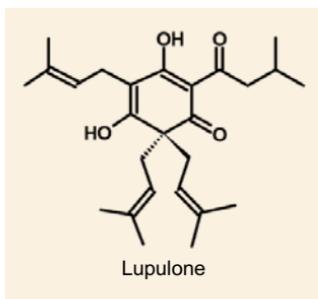
Tetrahydroisohumulone



Hexahydroisohumulone

Beta Acids

Traditionally, brewers considered beta acids such as lupulone as lacking inherent value for brewing. However, the potential of beta acids to contribute to brewing should not be overlooked: applying a series of isolation steps and chemical reactions converts beta acids into isoalpha acids. This processing helps derive value from a class of compounds that otherwise would be of little use in brewing.



Lupulone

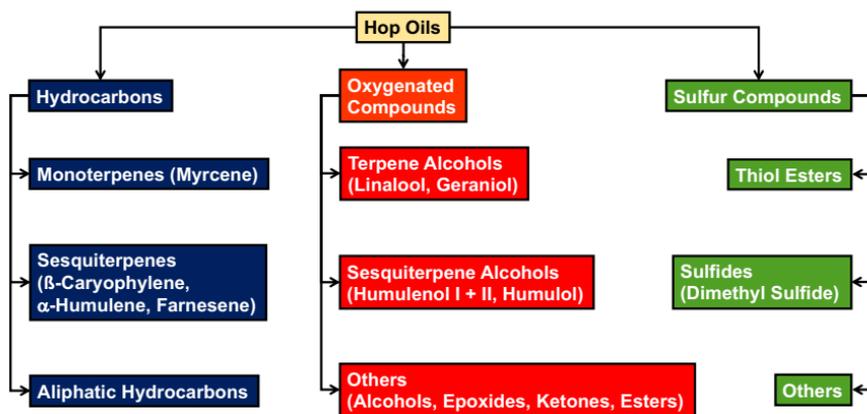
Outside of brewing, beta acids have a diverse set of applications. These compounds have antimicrobial activities against Gram-positive organisms such as *Lactobacillus*. In the sugar and fuel-ethanol sectors, beta acids provide an alternative



to antibiotics to keep microbial loads low during production. The bee-keeping industry faces major challenges from Varroa mites that decimate domesticated bee populations. This problem has implications not only for honey production, but also for agriculture that relies on bees for crop pollination. Beta acids function as effective mitocides when used in bee hives. Relative to other mitocides on the market, beta acid products such as HopGuard® are environmentally friendly and are nontoxic to humans.

Hop Oils

Essential oils are the soft resin component that provides hop aroma and taste to beer. Aroma and taste combine as “flavor.” Flavor compounds in hop oil fall in several different classes:



The most abundant chemicals in hop oils are myrcene, humulene, caryophyllene, farnesene, linalool, and geraniol. These compounds are the most typically cited in hop oil chemical analysis reports. Each of these oil components has unique sensory properties.

Myrcene: herbaceous, resinous, green, fresh hop, balsamic

Humulene: piney, woody

Caryophyllene: sweet, woody, spice, clove, dry

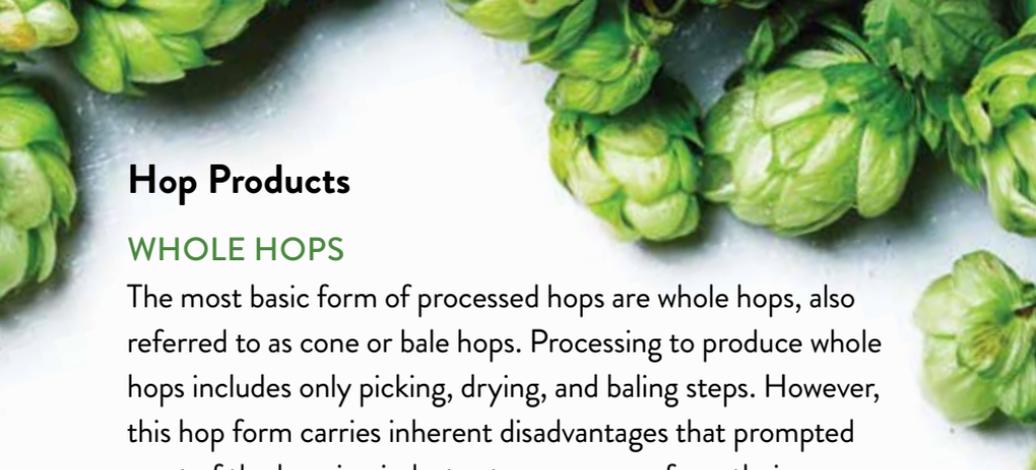
Farnesene: woody, citrus, sweet, green leafy, herbaceous

Linalool: floral, citrus

Geraniol: floral, rose, waxy, fruit

The flavor diversity found in just these most abundant compounds begins to illustrate the complex endeavor of understanding hop flavor. While only a handful of compounds are typically quantified during chemical analysis, hops actually contain hundreds of flavor species. Each individual oil component has distinct organoleptic properties across a wide range of attributes such as citrus, fruity, floral, wood, spice, and vegetal. In addition, synergistic interactions between compounds can enhance and/or deliver different flavors relative to the contribution of individual chemicals. Conversely, flavor molecules can interact in an antagonistic fashion where hop flavor is diminished or undesirable. The bottom line is that there is still much to learn about the intricacies of hop flavor.



A photograph of several fresh, green hop cones (bale hops) scattered across a light-colored surface. The cones are in various stages of maturity, showing their characteristic three-lobed structure.

Hop Products

WHOLE HOPS

The most basic form of processed hops are whole hops, also referred to as cone or bale hops. Processing to produce whole hops includes only picking, drying, and baling steps. However, this hop form carries inherent disadvantages that prompted most of the brewing industry to move away from their use. Baled hops are more susceptible to oxidation, which brings a concomitant loss of desirable aroma, bitterness, and flavor. Whole hops are also less homogeneous compared to products such as pellets and extracts. Hop bales are bulky, which significantly impacts cost related to storage, shipping, and handling. Improperly dried and monitored bales can present a significant fire hazard during storage. Further, to get the most brewing value from cone hops, specialized brewhouse equipment is needed. Even then, alpha acids utilization is lower relative to other hop products. Despite these challenges, some brewers still prefer whole hops over other hop product forms. This preference is driven by the belief that whole hops deliver more desirable flavor outcomes versus hops that have undergone further processing.

An increasingly popular category of whole hops are those known as fresh, green, or wet hops. After picking, these hops are not subjected to drying or other processing steps. Wet hops impart true-to-type varietal flavors of their dried counterparts, but at different intensity levels. In addition,



wet-hopped beers possess green, grassy, and vegetal notes along with a freshness and vibrancy not found in conventionally hopped beers. Yet, many of the disadvantages of dried whole hops are amplified in wet hops. Degradation rates are faster, thus wet hops must be used within a day or two of harvest. This limits the availability of wet hop beers to during the harvest season. The proportionally higher percentage of water in wet hops necessitates adding corresponding larger masses of hops to achieve bitterness and flavor targets. Specialized equipment or creative repurposing of existing equipment is needed to deal with the large mass and bulk of wet hops. Alpha acids utilization and brewing efficiencies are generally low. In addition, the shelf life of wet-hopped beers is shorter than that of conventional beers due to the rapid loss of fresh hop flavor.



HOP PELLETS

Pellets are the most commonly used hop product in the beer industry. Brewers can apply hops pellets in the same manner as whole hops. Applications range from imparting bitterness through kettle hop additions to flavor enhancement via dry-hopping during cellar operations. Upon addition to wort or beer, hop pellets readily disperse in these matrices to allow for extraction of bitterness, aroma, and/or flavor. The resultant spent hop solids are removed via settling, filtration, and/or centrifugation. A number of pellet products are commercially available.

Type 90 Pellets

The most commonly used hop pellets are those designated as Type 90 (T-90). Dried whole hops are first milled, then extruded through specialized machine dies into pellet form. Historically, the T-90 name described the mass composition of the early pellets produced under this designation. After processing, the pellets typically retained approximately 90% of the original hop mass. Today, mass retention in T-90 pellets is routinely greater than 90%, thus rendering the T-90 designation somewhat inaccurate. T-90 and other pellet types are popular because they offer advantages over whole hops. These include greater homogeneity, longer shelf life, smaller bulk, reduced fire risk, and lower shipping, storage, and handling costs.



Type 45 Pellets

Hops can be processed into pellet forms that are enriched in lupulin concentration. A popular example of concentrated/enriched pellets are the Type 45 (T-45) products. Concentration of hop resins occurs through the removal of a greater proportion of hop vegetative matter relative to T-90 pellets. This requires processing at below-freezing temperatures to mitigate the stickiness of the lupulin glands and facilitate the removal of the green matter. As for T-90 pellets, historical T-45 designations reflected how much of the original hop mass remained in the final product (in effect, 45% of the starting hop mass). Current pellet production practices typically yield greater than 45% of the original mass. This improvement is due to higher alpha acid content in contemporary hop varieties relative to their historical counterparts. This feature requires removal of less vegetative matter to achieve desired alpha acids concentrations. Brewers apply T-45 pellets to the same process points as whole and T-90 hops. However, due to their enriched nature, less mass is required relative to less concentrated hop forms to achieve the same brewing bittering and flavor targets. T-45 pellets also share the same advantages of T-90 pellets compared to whole hops.

LUPOMAX®

In 2020, HAAS® introduced LUPOMAX®—a highly consistent, concentrated lupulin pellet designed to deliver



optimized hop flavor. LUPOMAX is a varietal-specific, enriched hop pellet that offers consistent year-to-year and lot-to-lot alpha acid levels as well as flavor impact to beer. This consistency is achieved through Haas' exclusive Sensory Plus™ production program. Sensory Plus is sensory-based hop selection coupled with advanced technical analysis. Then, applying proprietary processing steps to the selected hops generates pellets that achieve targeted specifications for each LUPOMAX variety. Brewers can use LUPOMAX during production in the same manner as T-90 pellets; the recommended application of LUPOMAX is through addition to the whirlpool and/or dry-hopping during cellar operations. Because LUPOMAX is an enriched pellet, dosage rates are typically 70% of corresponding T-90 hop bills.



Isomerized Hop Pellets

Isomerized hop pellets (isopellets) are an alternative to conventional bittering kettle products, such as cones, T-90 pellets, concentrated pellets, or extract. A major benefit of isopellets is improved bitterness utilization compared to the products mentioned above. Isopellets follow the same general production techniques as T-90 pellets, but with two differences: 1) the addition of small quantities of magnesium oxide to the hop powder before pelletization, and 2) storage of packaged pelletized hops at approximately 50°C for one to two weeks. Under these conditions, the hop alpha acids almost completely isomerize into isoalpha acids.

Isopellets offer a way to directly add isoalpha acids into beer. The primary benefit is reflected in a significant increase in bitterness utilization. As a result, brewers can achieve significant potential savings in ingredient, shipping, and storage costs. Notably, however, the organoleptic properties that isohops impart to beer may not match conventional pellets. Brewers are cautioned to conduct flavor trials to determine the optimal isopellet/conventional pellet replacement rate.

HOP EXTRACT-BASED PRODUCTS

From an economic perspective, the most valuable hop components are the oleoresins in hop lupulin glands. These hop resins contain the bitterness, flavor, and aroma compounds that are important to beer. The most commonly used method



to separate hop resins from the bulk hop vegetative matter is through extraction processes. In addition to organoleptic attributes, hop extracts offer other attractive features and benefits. Compared to whole hops and pellets, extracts have longer shelf lives, are more concentrated, and increase brewing efficiencies. In addition, extracts have greater compositional uniformity versus whole hops. Extracts also offer a degree of flexibility because adjustments to production processes will yield extracts which meet different targeted chemical specifications.

Over the years hop extraction solvents have moved from ethanol and hexanes to carbon dioxide (CO_2), such as liquid carbon dioxide (LCO_2) or supercritical carbon dioxide (SCO_2). The use of CO_2 in hop extractions offers several advantages over conventional solvents. CO_2 is non-toxic, non-flammable, and does not leave trace residues behind. In addition, CO_2 can be removed without the loss of important volatile hop constituents. Both LCO_2 and SCO_2 are effective at extracting the desirable components from hops including alpha acids, beta acids, and essential oils. Extraction of other hop constituents occurs to varying degrees depending upon their solubility in LCO_2 or SCO_2 . Polyphenols and waxes do not undergo efficient extraction by CO_2 . As a result, these compounds represent only a small proportion of hop extract. For other hop components, solubility in CO_2 is dependent upon the state of the solvent. For example, chlorophyll and other plant pigments are extracted by SCO_2 but not LCO_2 .



CO₂ hop extract is sold in different forms. Undiluted resin, usually called pure resin extract, typically contains 30% to 65% alpha acids, depending on the characteristics of the original hops. Alternatively, production processes can standardize resins to specified alpha acids content using corn syrup or other plant syrup as a diluent. Standardized hop extract was once a popular product, but pure resin extract has gradually supplanted this form.

A number of reasons support the use of CO₂ hop extracts in place of other hop kettle products like pellets. These include:

1. They are the most stable form of hop product. Pure resin extracts can be stored for several years at ambient temperature with negligible loss of brewing value.
2. Utilization of hop extracts in the kettle is better than with traditional types of kettle hops.
3. Hop extracts are extremely uniform. The processing plant carefully adjusts alpha acids content to customer specifications for optimum consistency.
4. Shipping, storage weight, and volume are substantially reduced as only the extract material (typically 20-25% of the original hop material for high alpha hops) is retained and packaged.



FLEX® POURABLE BITTERING PRODUCT

FLEX® represents the next stage in the evolution of extract-based hop products. As an alternative to cones or pellets for kettle bittering applications, FLEX offers several benefits. The product is 100% hop-derived and presents no labelling issues when used in beer. Comprising 65% alpha acids, FLEX is the most concentrated alpha product currently available on the market. FLEX flows freely at ambient temperatures and does not require preheating or specialized dosing equipment. Dosing rate calculations follow the same format used for CO₂ extract. Alpha acid utilization during brewing is typically 10–20% (relative) greater when compared to pellets. Brewers should consider this feature in calculating brewing recipes where FLEX replaces pellets. The lack of vegetative matter in FLEX also confers additional efficiency gains when replacing pellets. For example, when using hop pellets, brewers can expect to lose 10 L of wort or beer for every kg of pellets used. These losses are minimized when FLEX is used in place of pellets. FLEX provides the added benefit of generating less solid waste, reducing waste handling costs and increasing brewery sustainability.



CO₂ EXTRACT & FLEX DOSING CALCULATIONS

Dosing calculations must accommodate the differences inherent across the types of hop products. The below formula may aid in calculating conventional CO₂ extract and FLEX dosing levels based on bitterness targets. Notably, equipment and techniques can vary considerably between breweries. As such, no single formula is sufficiently robust to account for all situations. If needed, HAAS sales or technical personnel will provide assistance with dosing calculations for specific brewing conditions.

When replacing hop pellets with conventional extract or FLEX, we recommend that brewers reduce the alpha acids kettle dosage by 10% to 20% (typically alpha utilization is increased by about 5% absolute, e.g., from 25% to 30%).

The basic calculation for hop dosing:

$$\text{kg product to dose} = (\text{hL} \times \text{ppm}) / (\%U \times \%conc)$$

- **hL** = Final beer volume in hectoliters (1 bbl = 1.174 hL)
- **ppm** = ppm isoalpha acids desired in final beer; roughly relates to bitterness units
- **%U** = Estimated percent utilization = (isoalpha acids in beer / alpha acids dosed) x 100
- **%conc** = Percent concentration of alpha acids in hop product



Example:

100 bbl finished beer, 40 ppm IAA desired, 30% utilization, 45% alpha acids in extract

$$([100 \times 1.174] \times 40) / (30 \times 45) = 4696 / 1350 = 3.48 \text{ kg extract to dose}$$

ISOMERIZED KETTLE EXTRACTS

Similar in concept to isopellets, these are hop-based extract products where the primary bittering components consists of pre-isomerized isoalpha acids. These products are known as isomerized kettle extracts (IKEs). Under controlled conditions, heating a mixture of pure resin CO₂ extract and magnesium salts (e.g., magnesium carbonate) will produce IKE. This process achieves conversion of alpha to isoalpha acids at greater than 95% efficiency. Of note, under these reaction conditions, hop oil composition may undergo changes that can impact beer flavor.

The use of IKE obviates the need for kettle isomerization of alpha acids. Bypassing this step results in increased bitterness utilization, with total values in the range of 45–55%. Brewers may apply IKE at any time during kettle boil. However, late-boil additions may influence beer aroma due to the hop oils present in IKE.



INCOGNITO®

INCOGNITO® is a flowable variety-specific extract of hops offered by HAAS. This product provides enhanced hop flavor and aroma to beer while enabling reductions in hop pellet use. The recommended application point for INCOGNITO is during hot-side additions to the whirlpool. With INCOGNITO, brewers can reduce pellet dry-hopping and still produce beers with robust hop aroma. Similar to FLEX, INCOGNITO contains no hop solids and eliminates wort losses associated with hop pellet liquid absorption. As a general rule of thumb, 1 g/L of INCOGNITO is approximately equivalent to 5.8 g/L of pellets. Given the diversity of equipment and brewing



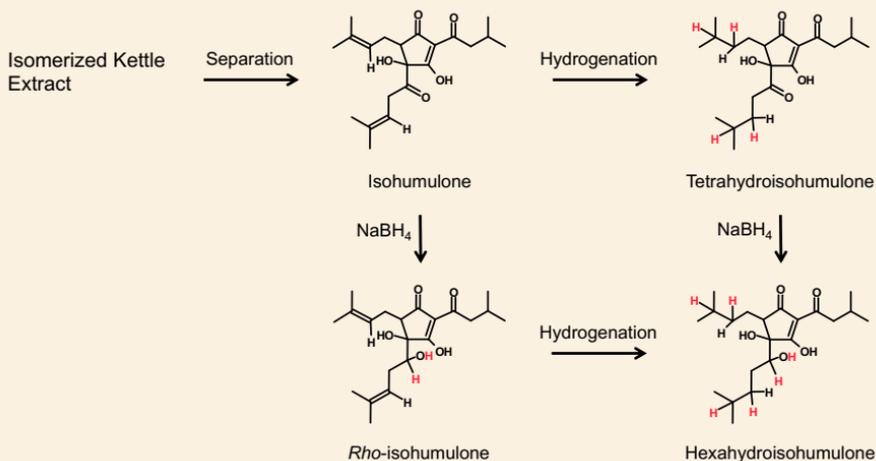
techniques across the industry, we recommend conducting small-scale brewing trials to assess INCOGNITO's performance under specific conditions. Brewers can calculate dosage based on the comparison to pellet dosage above or on INCOGNITO oil content. Alpha acids are a component of INCOGNITO and contribute to beer bitterness. Expect 2–10% alpha acid utilization depending upon timing of addition, temperature, and other whirlpool factors.

POST-FERMENTATION BITTERING PRODUCTS

Other available products give brewers added process flexibility. These include isoalpa, *rho*-isoalpa, tetrahydroisoalpa, and hexahydroisoalpa acids. Isoalpa acids are isolated from IKE through a series of extraction steps. Depending upon the chemistry applied, isoalpa acids can be converted into *rho*-isoalpa, tetrahydroisoalpa, or hexahydroisoalpa acids. A simplified process based on isohumulone appears in the diagram below. Potential applications for these products include increased bittering efficiency, bitterness augmentation, light-stable bittering, foam stabilization, and antimicrobial activity.

HAAS offers all of these products under the specific trade names Isohop® (isoalpa acids), Redihop® (*rho*-isoalpa acids), Tetrahop Gold® (tetrahydroisoalpa acids), and Hexahop Gold®/Hexahop 95® (hexahydroisoalpa acids). The features and benefits of each of these hop acids are outlined below.





Isohop[®]

Products based on isoalpa acids are more efficient at bittering beer relative to alpha acids-based offerings. Isohop[®] differs from isopellets and IKE in that alpha acids, beta acids, and waxes are not present in significant quantities. This product is sold as a 30% w/w aqueous solution of isoalpa acids in the form of potassium salts. Isohop is typically used post-fermentation to achieve International Bitterness Units (IBU) targets either as a part of the original hopping bill or to adjust bitterness in off-specification beer. From an economic standpoint, Isohop offers a number of attractive features and benefits. High utilization levels (60–90%) and the lack of vegetative matter offer increased production efficiencies. Isohop also has antimicrobial activity against Gram-positive bacteria and contributes to foam stability.



Redihop®

Light-struck character in beer primarily derives from the light-induced degradation of isoalpa acids. To inhibit this transformation, isoalpa acids are converted into light-stable analogs such as *rho*-isoalpa acids. The HAAS *rho*-isoalpa acids product is sold as Redihop®. Redihop is a 30% w/w aqueous solution of *rho*-isoalpa acids that imparts bitterness to beer while being resistant to light struck reactions. From a bitterness quality standpoint, Redihop contributes a pleasant and smooth bitterness when used in the brewing process. Relative to isoalpa acids, tasters perceive *rho*-isoalpa acids to be approximately 70% as bitter. Redihop also has antimicrobial activity.

Tetrahop Gold®

Tetrahydroisoalpa acids are another class of hop-derived compounds that can be used as light-stable bittering agents in beer. The bitterness perception of tetrahydroisoalpa acids are approximately 1.0 to 1.7 times that of isoalpa acids. Tetrahop Gold® is a 9% w/w aqueous formulation of tetrahydroisoalpa acids. In addition to providing light-stable bittering, Tetrahop Gold enhances beer foam in post-fermentation applications and has antimicrobial activity.

Hexahop Gold® and Hexahop 95®

A third class of isoalpa acid derivatives that are resistant to light-struck reactions are the hexahydroisoalpa acids. Similar to tetrahydroisoalpa acids, hexahydroisoalpa acids



improves foam stand and cling and has antimicrobial properties. Hexahop Gold® is a 10% w/w aqueous solution made up of 50% hexahydroisoalpha acids and 50% tetrahydroisoalpha acids. This product imparts smooth and clean bitterness to beer and is 1.0 to 1.3 times as bitter as isoalpha acids. Hexahop 95® is an aqueous 30% w/w mixture of 95:5 hexahydroisoalpha acids/tetrahydroisoalpha acids. From a sensory standpoint, Hexahop 95 provides clean, smooth bitterness at 1.0 to 1.1 times the bitterness intensity of isoalpha acids. The recommended application points for Hexahop Gold and 95 are post-fermentation and before final filtration.

DRY-HOP REPLACEMENT PRODUCTS

SPECTRUM

Dry-hopping is an important tool that enables brewers to impart desirable and impactful flavors to beer. The operational consequences for dry-hopping are the concomitant decreases in volume yields. As mentioned earlier, 10 L of beer is lost for every kg of hop vegetative matter that is added to a process step. Clearly, there is a need for an innovative product that delivers dry-hop flavor with minimal beer loss. Spectrum was developed to address these needs. It is a varietal-specific product that is available in popular varieties such as Citra® and Mosaic®. Compositionally, this liquid hop product is 100% hop-derived with no additives or non-aqueous solvents.

Spectrum contains no vegetative matter, thus eliminating beer loss through absorption on to hop solids. It can be applied at any



point during the brewing process, but the recommended usage is in cellar dry-hopping operations. No specialized dosage equipment is needed for the addition of Spectrum to process tanks. A general replacement range of T-90 pellets by Spectrum is 1:5 to 1:8 (w/w, Spectrum:T-90). When used in beer, Spectrum offers consistent, true-to-varietal hop flavor. In addition to brewing efficiency gains, Spectrum will not induce hop creep, is oxygen-free and poses no microbiological threat to your beers. Other benefits offered by Spectrum include reduced solid waste and lower shipping/storage costs.

POST-FERMENTATION AROMA PRODUCTS

PHA® Products

Ideally, brewers can enhance beer aroma by adding hop oils during post-fermentation unit operations. In practice this is difficult to accomplish—pure hop oils have poor solubility in aqueous solutions. To address this challenge, BarthHaas® offers a line of beer-soluble hop oil products: PHA Classics, Varietals, and Topnotes.

PHA production requires applying a series of proprietary extraction and distillation steps to hops to achieve specific aroma targets. PHAs are water-soluble and formulated to deliver consistent, specified hop aroma within each of the product lines. In addition, PHAs do not impart bitterness to beer and are light-stable. The PHA Classics impart specific aroma attributes like citrus, woody, or spicy. While PHA Classics are not varietal-specific, PHA Varietal and Topnote



versions are available in popular varieties. These products have specific applications: PHA Varietals provide late-hopping aroma, while PHA Topnotes provide dry-hopping character.

Miscellaneous Notes

This publication describes over 150 different hop varieties. Each page presents a specific hop and contains information on pedigree, flavor descriptions, and analytical chemistry data on key compounds.

PEDIGREE

Similar to the human condition, “nature” and “nurture” play significant roles in the flavors that hops bring to beer. On the “nature” side, breeders seek to produce plant crosses that perpetuate the positive traits of both parents. In a few cases, serendipitous discoveries revealed that hops of unknown parentage (e.g., Amarillo® VGXP01 c.v.) deliver unique and desirable flavors. Older European landrace varieties, such as Hallertau, were not developed via modern breeding practices. Instead, their unique characteristics evolved as a result of regional growing practices and local environmental factors. Ultimately, “nurture” factors such as agronomic practices and brewing techniques significantly influence how genetic characteristics related to flavor are expressed.



FLAVOR

Hops were traditionally categorized according to their primary application: bitterness or aroma. As alpha acids levels rose across many new cultivars, these distinctions became less clear. The newer hops can impart not only bitterness, but also significant amounts of desirable aroma attributes to beer. This trend led to coining the term “dual-purpose” to describe these hops.

On top of these developments, the craft beer revolution influences how brewers and beer drinkers regard hops. Brewers are increasingly creative in using hops to impart bold, desirable, and sometimes unconventional flavors in beer. They seek hops based on extensive knowledge of what is currently in the market in addition to a willingness to experiment with new varieties. In turn, consumers have developed a sophisticated understanding of hop varieties and flavor.

Given this landscape, it is unnecessary and somewhat limiting to assign a hop to one particular category. Hop flavor is an interplay between bitterness, taste, and aroma and is not based on a single factor. In some cases one of these factors predominates, but never to the exclusion of the others. As such, in this edition of the *Hops Companion* we have not labelled hop varieties as bittering, aroma, or dual purpose.

For each hop included in this guide, varietal flavor descriptions are based on whole hops that have been harvested and dried. There is a general correlation between whole hop flavor and its expression in beer. However, a word of caution is warranted;



there are instances where desirable sensory attributes expressed by hop cones in the field did not translate to beer.

For more information regarding hop aroma contribution to beer and specific aroma characterizations of many of the world's hop varieties, an excellent resource is *The Hop Aroma Compendium – A Flavour Guide*, published by BarthHaas GmbH & Co. KG - available at www.barthhaas.com.

HOP AROMA STANDARDS

HAAS, in collaboration with BarthHaas, developed a sensory lexicon specifically tailored to hop flavor. The language centers on 12 sensory categories: floral, citrus, sweet fruit, green fruit, berry & currant, cream caramel, woody aromatic, menthol, herbal, spicy, green-grassy, and vegetal. Each category encompasses a set of descriptors that provide reference points and anchors that are comprehensive and in line with user experiences. For example, sweet fruits comprises banana, watermelon, honeydew melon, peach, apricot, passion fruit, lychee, dried fruit, plum, pineapple, cherry, kiwi, mango, and guava as defining descriptors. In addition, graphical icons represent each sensory category. When used as part of the sensory description of hops, particular flavor attributes can be ascertained at a glance.

The sensory icons depicted on each varietal page describe the flavor of that hop. Inclusion of the icons are meant to provide quick visual references to help readers rapidly identify hops of interest.





FLORAL

Elderflower, chamomile blossom, lily of the valley, jasmine, apple blossom, rose, geranium, carnation, lilac, lavender



CITRUS

Grapefruit, orange, lemon, lime, bergamot, lemongrass, ginger, tangerine



SWEET FRUIT

Banana, watermelon, honeydew, melon, peach, apricot, passion fruit, lychee, dried fruit, plum, pineapple, cherry, kiwi, mango, guava



GREEN FRUIT

Pear, quince, apple, gooseberry, white wine grapes



BERRY & CURRANT

Cassis, blueberries, raspberries, blackberries, strawberries, black currant, red currant, wild strawberries, cranberries



CREAM CARAMEL

Butter, chocolate, yogurt, honey, cream, caramel, toffee, coffee, tonka, vanilla



WOODY AROMATIC

Tobacco, cognac, barrique, leather, woodruff, incense, myrrh, resin, cedar, pine, earthy



MENTHOL

Mint, lemon balm, camphor, menthol, wine yeast



HERBAL

Lovage, thuja, basil, parsley, tarragon, dill, fennel, thyme, rosemary, marjoram, green tea, black tea, mate tea, sage



SPICY

Pepper, chili, curry, juniper, aniseed, nutmeg, licorice, clove, gingerbread, fennel seeds



GREEN-GRASSY

Green-grassy, fresh cut grass, hay, tomato leaves, green peppers, nettle



VEGETAL

Celery stock, celery root, leek, onion, artichoke, garlic, wild garlic



HOP VARIETY DATA SOURCES

Association for the Development of Hop Agronomy (ADHA), Moxee WA USA

BarthHaas GmbH & Co. KG, Nuremberg Germany

Bohemia Hops, Žatec Czechia

British Hop Association, Kent England

CLS Farms, Moxee WA USA

Comptoir Agricole Breeding Program, Strasbourg France

Hop Breeding Company (HBC), Yakima WA USA

Hop Growers of America (HGA), Moxee WA USA

Hop Products Australia (HPA), Hobart Australia

Hop Research Institute, Co., Ltd., Žatec Czechia

Hopsteiner, Inc., New York USA

PolishHops, Karczmiska Poland

Prof. Waclaw Dabrowski Institute of Agriculture and Food Biotechnology, Warsaw Poland



John I. Haas, Inc. (HAAS®), Yakima WA USA

New Zealand Hops Limited, Nelson New Zealand

Slohops, Prebold Slovenija

United States Department of Agriculture - Agricultural
Research Service (USDA-ARS), USA

Verband Deutscher Hopfenpflanzer e.V. - Wolnzach,
Germany

Yakima Chief Hops, Inc. (YCH), Yakima WA USA

ZA Hops, LLC, Fort Collins CO USA



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ADEENA®

ADHA 1940

Adeena® ADHA 1940 was commercially released by the Association for the Development of Hop Agronomy (ADHA) in 2020. This cultivar is the progeny of a Summit female and an ADHA 34/95/57 c.v. male. Agronomically, Adeena was selected for its excellent yields, disease, and pest resistance. Adeena is described as bringing gentle, delicate, and New World noble flavors to beer.



HERBAL



SPICY



FLORAL



CITRUS



WOODY
AROMATIC

Generic herbal, celery seed, lavender, lemon, pine.

Alpha (%)	3.5-5.5
Beta (%)	3.0-4.6
Cohumulone (% of Alpha Acids)	34-38
Total Oil (ml/100g)	0.8-1.1
Myrcene (% of Total Oil)	27.3-29.4
Humulene (% of Total Oil)	31.3-45.4
Caryophyllene (% of Total Oil)	14.6-21.9
Farnesene (% of Total Oil)	4.3-6.6
Linalool (% of Total Oil)	—
Total Polyphenols (%)	—



ADMIRAL

Bred at the Wye College to complement the variety Target. Admiral was derived from Challenger and Northdown breeding lines. It grows vigorously and produces high alpha.



HERBAL

SWEET
FRUIT

CITRUS

Tea, ripe kiwi, lemony.

Alpha (%)	13-16
Beta (%)	4-6
Cohumulone (% of Alpha Acids)	37-45
Total Oil (ml/100g)	1.0-1.7
Myrcene (% of Total Oil)	45
Humulene (% of Total Oil)	23-26
Caryophyllene (% of Total Oil)	—
Farnesene (% of Total Oil)	2
Linalool (% of Total Oil)	—
Total Polyphenols (%)	—



AFRICAN QUEEN

African Queen is a South African bred hop designed to perform well with the shorter day-lengths of the growing region. It originated from a diploid seedling from a cross between Experimental 91J7/25 c.v. and a South African male 94US2/118 c.v.



BERRY &
CURRANT



SWEET
FRUIT



CITRUS

Blueberry, melon, lemongrass.

Alpha (%)	10-17
Beta (%)	4-6
Cohumulone (% of Alpha Acids)	22-27
Total Oil (ml/100g)	0.7-1.5
Myrcene (% of Total Oil)	25-29
Humulene (% of Total Oil)	21-30
Caryophyllene (% of Total Oil)	10-13
Farnesene (% of Total Oil)	5-7
Linalool (% of Total Oil)	<1
Total Polyphenols (%)	—



AGNUS

The name Agnus arose from the Latin translation of Berárnek, the surname of a Czech hop breeder. Released in 2001, Agnus is derived from hybrid progenies of Bor, Sládek, Saaz, Northern Brewer, Fuggle and other breeding material.



FLORAL

WOODY
AROMATIC

SPICY

Lavender, lovage, leather, tobacco.

Alpha (%)	9.0-12.0
Beta (%)	4.0-6.5
Cohumulone (% of Alpha Acids)	29-38
Total Oil (ml/100g)	2.0-3.0
Myrcene (% of Total Oil)	40-55
Humulene (% of Total Oil)	15-25
Caryophyllene (% of Total Oil)	9-15
Farnesene (% of Total Oil)	< 1
Linalool (% of Total Oil)	0.3-0.5
Total Polyphenols (%)	4.0-5.5



AHTANUM®

Ahtanum® is a cultivar named after the district in which it is grown near Yakima. Ahtanum was developed through the Yakima Chief Ranches (YCR) breeding program and has an appealing aroma with exceptionally floral notes. It is used for its aromatic properties and moderate bittering.



WOODY
AROMATIC



FLORAL



CITRUS

Cedar, generic floral, grapefruit.

Alpha (%)	4.0-6.0
Beta (%)	4.0-6.0
Cohumulone (% of Alpha Acids)	30-35
Total Oil (ml/100g)	0.5-1.7
Myrcene (% of Total Oil)	50-65
Humulene (% of Total Oil)	12-20
Caryophyllene (% of Total Oil)	7-10
Farnesene (% of Total Oil)	0.1-1
Linalool (% of Total Oil)	0.2-0.5
Total Polyphenols (%)	—



AKOYA™

Akoya™ Experimental 99/268 c.v. is an early harvest variety released by Hopsteiner in 2019. It is a daughter of a cross between Zenith and a Hopsteiner male. The hop has a flavor profile that is characterized by herbal, tea, spice, and fruit notes. It displays resistance to mildew, wilt, and drought stress.



HERBAL



SPICY



GREEN
FRUIT

Tea, pepper, generic green fruits.

Alpha (%)	9-10
Beta (%)	4-5
Cohumulone (% of Alpha Acids)	27-30
Total Oil (ml/100g)	1.5-2.0
Myrcene (% of Total Oil)	—
Humulene (% of Total Oil)	—
Caryophyllene (% of Total Oil)	—
Farnesene (% of Total Oil)	—
Linalool (% of Total Oil)	0.6-0.8
Total Polyphenols (%)	4-5



ALTUS™

Altus™ Experimental 07270 c.v. is a 2020 release from the Hopsteiner breeding program as a late harvest cultivar. The hop's parentage is Apollo™ and Wye Target. Altus offers sensory notes of resin, tangerine, herbal, and grass.



SPICY

WOODY
AROMATIC

CITRUS

Spicy, resinous, tangerine.

Alpha (%)	15.0-18.5
Beta (%)	4.0-5.2
Cohumulone (% of Alpha Acids)	26-29
Total Oil (ml/100g)	3.0-4.4
Myrcene (% of Total Oil)	—
Humulene (% of Total Oil)	—
Caryophyllene (% of Total Oil)	—
Farnesene (% of Total Oil)	0.1-0.3
Linalool (% of Total Oil)	0.9-1.2
Total Polyphenols (%)	—



AMARILLO®

VGXP01 c.v.

UNITED STATES

Amarillo® VGXP01 c.v. is a variety derived from open-pollination and introduced by Virgil Gamache Farms Inc., in Washington State. The hop is characterized by mid to high alpha and low cohumulone content. Amarillo typically provides flavors of ripe, sweet citrus like tangerine and lemon, with stone fruits, melon, and wildflowers.



CITRUS



SWEET
FRUIT



FLORAL

Tangerine, lemon, apricot, melon, wild flowers.

Alpha (%)	8.0-11.0
Beta (%)	6.0-7.0
Cohumulone (% of Alpha Acids)	21-24
Total Oil (ml/100g)	1.5-1.9
Myrcene (% of Total Oil)	68-70
Humulene (% of Total Oil)	9-11
Caryophyllene (% of Total Oil)	2-4
Farnesene (% of Total Oil)	2-4
Linalool (% of Total Oil)	—
Total Polyphenols (%)	—



APOLLO™

This super high alpha variety was developed through the Hopsteiner Breeding Program and released in 2006. It is resistant to powdery and downy mildew. Apollo™ has very high alpha, good storage stability and low cohumulone. Added late into the brew boil, it imparts citrus and pine notes.



CITRUS

WOODY
AROMATIC

Lime, grapefruit, pine.

Alpha (%)	15.0-19.0
Beta (%)	5.5-8.0
Cohumulone (% of Alpha Acids)	24-28
Total Oil (ml/100g)	0.8-2.5
Myrcene (% of Total Oil)	30-55
Humulene (% of Total Oil)	20-35
Caryophyllene (% of Total Oil)	14-20
Farnesene (% of Total Oil)	< 1
Linalool (% of Total Oil)	0.2-0.4
Total Polyphenols (%)	—



ARAMIS

Aramis is a family member of the most important aroma hop variety in the Alsace region—the traditional Strisselspalt. It was established to create a similar aroma profile to Strisselspalt, but with increased and more stable bitter potential. It was bred from a 2002 cross between Strisselspalt and English Whitbread Golding.



SPICY



CITRUS



HERBAL

Spicy and mild notes, slightly citrus and herbal.

Alpha (%)	5.5-7.5
Beta (%)	3-4.5
Cohumulone (% of Alpha Acids)	20-22
Total Oil (ml/100g)	1.2-1.6
Myrcene (% of Total Oil)	38-41
Humulene (% of Total Oil)	19-21
Caryophyllene (% of Total Oil)	—
Farnesene (mg/100g)	2-4
Linalool (mg/100g)	10-16
Total Polyphenols (%)	—



ARIANA

Ariana is a variety developed at the Hop Research Center in Hüll. It is a 2010 cross between Herkules and a wild male hop.



SWEET
FRUIT



BERRY &
CURRANT



FLORAL



CITRUS

Passion fruit, pineapple, black currant, jasmine, tangerine.

Alpha (%)	10.0-13.0
Beta (%)	4.5-6.0
Cohumulone (% of Alpha Acids)	40-42
Total Oil (ml/100g)	1.6-2.4
Myrcene (% of Total Oil)	47.0-57.6
Humulene (% of Total Oil)	—
Caryophyllene (% of Total Oil)	—
Farnesene (% of Total Oil)	—
Linalool (% of Total Oil)	0.5-0.6
Total Polyphenols (%)	2.9-3.3



AURORA

This variety was bred at the Slovenian Institute of Hop Research and Brewing. Aurora was derived from English Northern Brewer and Slovenian germplasm. Aurora has an intense and pleasant hoppy aroma and exhibits a very good storage stability. Beer prepared with this variety has been shown to have good organoleptic scores with an intense and pleasant hop note. The yield of alpha acids is very good when brewing with this variety.



CITRUS



SPICY



FLORAL

Bergamot, lemongrass, aniseed, generic floral.

Alpha (%)	7.2-12.6
Beta (%)	2.7-4.4
Cohumulone (% of Alpha Acids)	22-26
Total Oil (ml/100g)	0.9-1.6
Myrcene (% of Total Oil)	35-53
Humulene (% of Total Oil)	20-27
Caryophyllene (% of Total Oil)	4-8
Farnesene (% of Total Oil)	6-9
Linalool (% of Total Oil)	0.6-1.0
Total Polyphenols (%)	—



AZACCA®

ADHA 483 c.v.

Azacca® ADHA 483 c.v. is named for the Haitian god of agriculture. It was developed through the Association for the Development of Hop Agronomy (ADHA) in Yakima. Azacca is a high alpha, high oil variety which exhibits a complex range of fruit, spice, and wood aromas.



SWEET
FRUIT



CITRUS



WOODY
AROMATIC



GREEN-
GRASSY

Ripe mango, papaya, pineapple, Valencia orange, grapefruit, pine resin, fresh grass.

Alpha (%)	14-16
Beta (%)	4.0-5.5
Cohumulone (% of Alpha Acids)	38-45
Total Oil (ml/100g)	1.6-2.5
Myrcene (% of Total Oil)	46-55
Humulene (% of Total Oil)	14-18
Caryophyllene (% of Total Oil)	8-12
Farnesene (% of Total Oil)	< 1
Linalool (% of Total Oil)	—
Total Polyphenols (%)	—



BAČKA

Bačka (pronounced batch-ka) is an old land race variety from the Serbia region registered with the United States Department of Agriculture (USDA) dating back to 1956. However, some sources believe it was derived from populations grown toward the end of the 19th century. Bačka-named hops were available in the market before the First World War. In some circles, Bačka is considered to be a noble aroma variety.



SPICY

Noble.

Alpha (%)	2.0-5.0
Beta (%)	4.0-7.4
Cohumulone (% of Alpha Acids)	25
Total Oil (ml/100g)	0.60
Myrcene (% of Total Oil)	50
Humulene (% of Total Oil)	24
Caryophyllene (% of Total Oil)	12
Farnesene (% of Total Oil)	—
Linalool (% of Total Oil)	—
Total Polyphenols (%)	—



BARBE ROUGE

Barbe Rouge is a recently developed variety through the Comptoir Agricole breeding program. The hop is of French parentage from the Alsace region of which Strisselspalt is one.



BERRY &
CURRANT



CITRUS

Red currant, cassis, strawberry, orange, lime.

Alpha (%)	7.5-9.5
Beta (%)	3.5-4.6
Cohumulone (% of Alpha Acids)	25-28
Total Oil (ml/100g)	1.8-2.2
Myrcene (% of Total Oil)	52-58
Humulene (% of Total Oil)	17-21
Caryophyllene (% of Total Oil)	—
Farnesene (mg/100g)	0-3
Linalool (mg/100g)	12-16
Total Polyphenols (%)	—



BOADICEA

Boadicea is a dwarf variety bred as a general purpose hop with moderate alpha, good flavor and aphid resistance. It was bred from an open pollination of a second-generation female from a wild Japanese source. The grandfather of Boadicea is also the father of First Gold and Pioneer. Boadicea was named after a Celtic warrior queen who resisted the Roman invasion centuries ago.



SWEET
FRUIT



WOODY
AROMATIC



MENTHOL



SPICY

Orchard fruits, pine, tobacco, peppermint, licorice.

Alpha (%)	7-10
Beta (%)	3-4
Cohumulone (% of Alpha Acids)	26
Total Oil (ml/100g)	1.4-2.0
Myrcene (% of Total Oil)	33
Humulene (% of Total Oil)	20
Caryophyllene (% of Total Oil)	—
Farnesene (% of Total Oil)	5
Linalool (% of Total Oil)	—
Total Polyphenols (%)	—



BOBEK

Bobek, also known as Styrian Golding B, is a diploid hybrid cross between Northern Brewer and Slovenian male germplasm, derived from the same family as Aurora. It has very good agronomic traits and processes well.



VEGETAL



GREEN-GRASSY



CITRUS



MENTHOL

Artichoke, hay, lemon, sage.

Alpha (%)	3.5-7.8
Beta (%)	4.0-6.1
Cohumulone (% of Alpha Acids)	28-34
Total Oil (ml/100g)	0.7-4.0
Myrcene (% of Total Oil)	49-57
Humulene (% of Total Oil)	13-19
Caryophyllene (% of Total Oil)	4-6
Farnesene (% of Total Oil)	4-7
Linalool (% of Total Oil)	0.9-1.3
Total Polyphenols (%)	—



BOHEMIE

Bohemie was bred from Saaz and Sládek, and released in 2010 by the Hop Research Institute Co., Ltd., in Zatec, Czechia. The variety yields better than Saaz and has firm hop cones which makes it easy to pick. The hop was derived from hybrid progenies of Sládek and breeding material with origin in Saaz.



SPICY



FLORAL



CITRUS

Generic spicy, floral, citrus.

Alpha (%)	5.0-8.0
Beta (%)	6.0-9.0
Cohumulone (% of Alpha Acids)	23-26
Total Oil (ml/100g)	1.0-1.5
Myrcene (% of Total Oil)	30-45
Humulene (% of Total Oil)	17-23
Caryophyllene (% of Total Oil)	7-10
Farnesene (% of Total Oil)	1-3
Linalool (% of Total Oil)	0.50-0.75
Total Polyphenols (%)	3.5-4.5



BOR

Bor, which means pine, was registered as a dual-purpose variety in 1994. It was named after the pine woods, which are typical for a region in Czechia. The hop was derived from Northern Brewer.



SPICY



FLORAL



CITRUS

Mild baking spice, generic floral, citrus.

Alpha (%)	6.0-9.0
Beta (%)	3.0-5.5
Cohumulone (% of Alpha Acids)	22-27
Total Oil (ml/100g)	1.2-2.0
Myrcene (% of Total Oil)	40-55
Humulene (% of Total Oil)	25-40
Caryophyllene (% of Total Oil)	9-14
Farnesene (% of Total Oil)	<1.0
Linalool (% of Total Oil)	0.2-0.3
Total Polyphenols (%)	3.5-5.0



BOUCLIER

Bouclier was bred from a 2005 cross between the French Strisselspalt and a British male plant grown in Wye, Kent, UK. Also part of its genealogy are Wye Challenger, Early Bird Golding and Northern Brewer. The name Bouclier is French for “shield.”



CITRUS



HERBAL



SPICY

Fruity esters, lemon, generic herbal, lovage.

Alpha (%)	3.8-6.0
Beta (%)	2.3-3.3
Cohumulone (% of Alpha Acids)	—
Total Oil (ml/100g)	1.1-1.6
Myrcene (% of Total Oil)	38
Humulene (% of Total Oil)	34
Caryophyllene (% of Total Oil)	—
Farnesene (mg/100g)	—
Linalool (mg/100g)	7.8
Total Polyphenols (%)	—



BRAMLING CROSS

Bred from a crossing in 1927
by Professor Salmon at Wye,
of a Bramling (one of the traditional
Golding varieties) with a male seedling
from a Canadian Manitoban wild hop.



FLORAL



CITRUS

CREAM
CARAMELGREEN
FRUIT

Chrysanthemum, grapefruit, caramel, vanilla, gooseberry.

Alpha (%)	6-8
Beta (%)	2.3-3.5
Cohumulone (% of Alpha Acids)	34
Total Oil (ml/100g)	0.7-1.2
Myrcene (% of Total Oil)	36
Humulene (% of Total Oil)	25
Caryophyllene (% of Total Oil)	15-19
Farnesene (% of Total Oil)	< 1
Linalool (% of Total Oil)	—
Total Polyphenols (%)	—



BRAVO™

Bravo™ is a second generation super high alpha variety developed by the Hopsteiner Breeding Program and released in 2006. It has good resistance to powdery mildew.



CITRUS

SWEET
FRUIT

FLORAL

Orange, candied lime, stone fruit, generic floral.

Alpha (%)	14.0-17.0
Beta (%)	3.0-5.0
Cohumulone (% of Alpha Acids)	29-34
Total Oil (ml/100g)	1.6-2.4
Myrcene (% of Total Oil)	25-50
Humulene (% of Total Oil)	18-20
Caryophyllene (% of Total Oil)	10-12
Farnesene (% of Total Oil)	< 1
Linalool (% of Total Oil)	—
Total Polyphenols (%)	—



BREWERS GOLD

Professor E.F. Salmon of Wye College in Kent, England, was responsible for breeding the variety Brewers Gold. This hop is well known all over the world and has been used in many international breeding programs. This is due to its moderate alpha acid content, high yield, and vigorous growth. It was developed from an open pollination of the wild Canadian Manitoba BB1 c.v. hop. Brewers Gold has been grown in the Alsace region of France since the late '60s.



BERRY &
CURRANT



HERBAL



CITRUS



SPICY

Black currant, tea, lemon, lovage.

Alpha (%)	4.5-6.5
Beta (%)	2.5-3.5
Cohumulone (% of Alpha Acids)	36-45
Total Oil (ml/100g)	0.8-1.8
Myrcene (% of Total Oil)	40-50
Humulene (% of Total Oil)	20-30
Caryophyllene (% of Total Oil)	10-15
Farnesene (mg/100g)	—
Linalool (mg/100g)	4
Total Polyphenols (%)	—



BRU-1™

BRU-1™ was developed by Brulotte Farms in Toppenish, WA. It is notable for its distinct sweet fruit aroma that is often described as pineapple. BRU-1 is synergistic with other hops, creating a pleasing depth of fruit flavor. In certain beer styles, BRU-1 has also been shown to improve haze stability.



SWEET
FRUIT



GREEN
FRUIT



GREEN-
GRASSY

Pineapple, pear, apple, fresh cut grass.

Alpha (%)	13.0-15.0
Beta (%)	8.0-10.0
Cohumulone (% of Alpha Acids)	35-37
Total Oil (ml/100g)	1.5-2.0
Myrcene (% of Total Oil)	50-55
Humulene (% of Total Oil)	7-8
Caryophyllene (% of Total Oil)	9-11
Farnesene (% of Total Oil)	< 1
Linalool (% of Total Oil)	—
Total Polyphenols (%)	—



CALLISTA

Developed at the Hop Research Center in Hüll, and formerly named 2010/008/033 c.v. during trials. This high beta-acids hop variety is derived from German hop material from the famous Hallertau Tradition variety. Callista has many meanings, but it is most commonly defined as “most beautiful (feminine)” in Greek.



BERRY &
CURRANT



CITRUS



SWEET
FRUIT



GREEN
FRUIT



CREAM
CARAMEL

Strawberry, orange, passion fruit, pear, caramel.

Alpha (%)	2.0-5.0
Beta (%)	5.0-10.0
Cohumulone (% of Alpha Acids)	15-22
Total Oil (ml/100g)	1.4-2.1
Myrcene (% of Total Oil)	54.0-63.5
Humulene (% of Total Oil)	—
Caryophyllene (% of Total Oil)	—
Farnesene (% of Total Oil)	—
Linalool (% of Total Oil)	1.3
Total Polyphenols (%)	4.1-6.2



CALYPSO™

Calypso™ is a diploid hop developed from the Hopsteiner breeding program. It exhibits pleasant fruity characteristics. Calypso is resistant to powdery and downy mildews.



GREEN
FRUIT



SWEET
FRUIT

Pear, apple, tropical fruit, melon.

Alpha (%)	12.0-14.0
Beta (%)	5.0-6.0
Cohumulone (% of Alpha Acids)	40-42
Total Oil (ml/100g)	1.6-2.5
Myrcene (% of Total Oil)	30-45
Humulene (% of Total Oil)	20-35
Caryophyllene (% of Total Oil)	9-15
Farnesene (% of Total Oil)	< 1
Linalool (% of Total Oil)	—
Total Polyphenols (%)	—



CASCADE

Cascade was developed in the United States Department of Agriculture (USDA) breeding program at Oregon State University and released in 1972. It is characterized by its dark green elongated cone. For many years, Cascade was the definitive hop of American craft brews. It was obtained by crossing an English Fuggle with a male plant derived from the Russian variety, Serebrianka.



FLORAL



CITRUS

WOODY
AROMATIC

Floral, grapefruit, pine resin.

Alpha (%)	4.5-7.0
Beta (%)	4.8-7.0
Cohumulone (% of Alpha Acids)	33-40
Total Oil (ml/100g)	0.7-1.4
Myrcene (% of Total Oil)	45-60
Humulene (% of Total Oil)	8-13
Caryophyllene (% of Total Oil)	3-6
Farnesene (% of Total Oil)	3-7
Linalool (% of Total Oil)	—
Total Polyphenols (%)	4.5-4.9



CASHMERE

Cashmere was developed and released through the Washington State University United States Department of Agriculture (USDA) hop breeding program in 2013. It is a daughter of a Cascade male and a female line that includes Northern Brewer.



CITRUS

SWEET
FRUIT

HERBAL

Lemon, lime, ripe melon, stone fruit, thyme.

Alpha (%)	7.7-9.1
Beta (%)	3.5-4.5
Cohumulone (% of Alpha Acids)	22-24
Total Oil (ml/100g)	1.2-1.4
Myrcene (% of Total Oil)	39-42
Humulene (% of Total Oil)	26-29
Caryophyllene (% of Total Oil)	12-13
Farnesene (% of Total Oil)	< 1
Linalool (% of Total Oil)	—
Total Polyphenols (%)	—



CELEIA

Celeia, also known as Styrian Golding C, is a triploid hybrid from a cross of auto-tetraploid Savinjski Golding and the 105/58 c.v. hybrid between Aurora (Super Styrian) and a Slovenian wild hop.



CITRUS



MENTHOL



HERBAL

Lemon, lime, peppermint, thyme, tea.

Alpha (%)	3.0-6.5
Beta (%)	2.0-3.3
Cohumulone (% of Alpha Acids)	26-29
Total Oil (ml/100g)	1.5-3.6
Myrcene (% of Total Oil)	26-40
Humulene (% of Total Oil)	18-23
Caryophyllene (% of Total Oil)	8-9
Farnesene (% of Total Oil)	3-7
Linalool (% of Total Oil)	0.6-1.2
Total Polyphenols (%)	—



CENTENNIAL

Named after the Washington State centennial anniversary in 1989. Centennial arose from the United States Department of Agriculture (USDA) hop breeding program at Washington State University in 1974 and released in 1990. Its genetic composition is 3/4 Brewers Gold, 3/32 Fuggle, 1/16 East Kent Golding, 1/32 Bavarian and 1/16 unknown.



CITRUS

SWEET
FRUITWOODY
AROMATIC

FLORAL

Orange, lime, cherry, pine resin, orange blossom.

Alpha (%)	9.5-11.5
Beta (%)	3.4-4.5
Cohumulone (% of Alpha Acids)	29-30
Total Oil (ml/100g)	1.5-2.5
Myrcene (% of Total Oil)	45-55
Humulene (% of Total Oil)	10-18
Caryophyllene (% of Total Oil)	5-8
Farnesene (% of Total Oil)	< 1
Linalool (% of Total Oil)	—
Total Polyphenols (%)	—



CHELAN

Chelan was developed through the John I. Haas breeding program and released in 1994. Chelan is a daughter of Galena and relative to her mother, has improved agronomics. Historically, Chelan found use primarily as a bittering hop.



CREAM
CARAMEL



BERRY &
CURRANT



GREEN
FRUIT



SWEET
FRUIT



CITRUS

Cream, strawberry, gooseberry.

Alpha (%)	12.0-14.5
Beta (%)	8.5-9.8
Cohumulone (% of Alpha Acids)	33-35
Total Oil (ml/100g)	1.5-1.9
Myrcene (% of Total Oil)	45-55
Humulene (% of Total Oil)	12-15
Caryophyllene (% of Total Oil)	9-12
Farnesene (% of Total Oil)	< 1
Linalool (% of Total Oil)	—
Total Polyphenols (%)	—



CHINOOK

Chinook was developed by the United States Department of Agriculture (USDA) breeding program in Washington State and released in 1985. Originally released as a high alpha variety, Chinook has gained favor in craft brewing with its distinctive aroma. This cultivar takes its name from a Native American tribe indigenous to the region around Washington State. The female parent is one of the English Goldings.



CITRUS

SWEET
FRUITWOODY
AROMATIC

SPICY

Grapefruit, apricot, pine resin, juniper.

Alpha (%)	12.0-14.0
Beta (%)	3.0-4.0
Cohumulone (% of Alpha Acids)	29-35
Total Oil (ml/100g)	1.7-2.7
Myrcene (% of Total Oil)	35-40
Humulene (% of Total Oil)	18-23
Caryophyllene (% of Total Oil)	9-11
Farnesene (% of Total Oil)	< 1
Linalool (% of Total Oil)	—
Total Polyphenols (%)	—



CITRA®

HBC 394 c.v.

Citra® HBC 394 c.v. is a hop variety released in 2008 by the Hop Breeding Company (HBC).

It possesses unique and highly favored flavor characteristics. Citra originated from a cross between Hallertauer Mittelfrüh and a father derived from U.S. Tettnanger.



SWEET
FRUIT



CITRUS



FLORAL

Mango, grapefruit flesh, lime zest.

Alpha (%)	11.0-13.0
Beta (%)	3.5-4.5
Cohumulone (% of Alpha Acids)	22-24
Total Oil (ml/100g)	2.2-2.8
Myrcene (% of Total Oil)	60-65
Humulene (% of Total Oil)	11-13
Caryophyllene (% of Total Oil)	6-8
Farnesene (% of Total Oil)	< 1
Linalool (% of Total Oil)	1-2
Total Polyphenols (%)	4.5-5.5



CLUSTER

Cluster is one of the oldest varieties grown in the U.S. The rootstock origin is uncertain. Until the late 1970s, Cluster was one of only a few varieties grown in the U.S. and dominated the farm acreage. Alpha content is medium, aroma is strong and storage stability of the alpha acids is excellent. The variety grows with good vigor and cone production.



FLORAL

SWEET
FRUIT

CITRUS

Lilac, apricot, lemon.

Alpha (%)	5.5-8.5
Beta (%)	4.5-5.5
Cohumulone (% of Alpha Acids)	37-43
Total Oil (ml/100g)	0.4-0.8
Myrcene (% of Total Oil)	45-55
Humulene (% of Total Oil)	15-18
Caryophyllene (% of Total Oil)	6-7
Farnesene (% of Total Oil)	< 1
Linalool (% of Total Oil)	—
Total Polyphenols (%)	—



COLUMBUS

Columbus, Tomahawk® and Zeus (CTZ) are super high alpha varieties. They share the same female parent as Nugget making them at least half sisters to Nugget. The CTZ varieties are currently used almost exclusively for beer bittering.



CITRUS



SPICY



VEGETAL

SWEET
FRUIT

Lemon, black pepper, green onion, mango.

Alpha (%)	15.0-17.0
Beta (%)	4.5-5.0
Cohumulone (% of Alpha Acids)	28-32
Total Oil (ml/100g)	2.5-3.5
Myrcene (% of Total Oil)	50-60
Humulene (% of Total Oil)	12-18
Caryophyllene (% of Total Oil)	9-11
Farnesene (% of Total Oil)	< 1
Linalool (% of Total Oil)	—
Total Polyphenols (%)	—



COMET

Comet is a hop variety with relatively high alpha content and provides a wild American aroma. It was released as a high alpha hop from the United States Department of Agriculture (USDA) hop breeding program in 1975 primarily for production in Washington and Idaho. Comet has become a popular variety to grow in Germany.



CITRUS

BERRY &
CURRANTSWEET
FRUIT

Mandarin, lemongrass, black currant, apricot, pineapple.

Alpha (%)	9.4-12.4
Beta (%)	3.0-6.1
Cohumulone (% of Alpha Acids)	40-45
Total Oil (ml/100g)	1.4-3.3
Myrcene (% of Total Oil)	40-65
Humulene (% of Total Oil)	1-2
Caryophyllene (% of Total Oil)	5-7
Farnesene (% of Total Oil)	<1
Linalool (% of Total Oil)	—
Total Polyphenols (%)	—



CONTESSA™

Contessa™ Experimental 04190 c.v. is a noble aroma-type cultivar released by the Hopsteiner breeding program. It originated from a cross between Fuggle and Cascade. Contessa is a low alpha hop and is described as having floral, pear, and tea aroma attributes.



HERBAL



FLORAL

GREEN
FRUIT

Green tea, floral, light pear.

Alpha (%)	3-5
Beta (%)	5.0-7.4
Cohumulone (% of Alpha Acids)	29-32
Total Oil (ml/100g)	0.8-1.9
Myrcene (% of Total Oil)	—
Humulene (% of Total Oil)	—
Caryophyllene (% of Total Oil)	—
Farnesene (% of Total Oil)	4.0-5.5
Linalool (% of Total Oil)	0.9-1.0
Total Polyphenols (%)	—



CRYSTAL

Crystal is a triploid variety developed from the German aroma hop variety Hallertauer Mittelfrüh with lineage contributions from Cascade, Brewer's Gold and Early Green. Released in 1993 from the United States Department of Agriculture (USDA) breeding program, Crystal has become popular in U.S. craft brewing as a triploid Hallertau type. It is a half-sister of Mt. Hood and Liberty.



WOODY
AROMATIC



FLORAL



SPICY

Cedar, myrrh, chamomile, nutmeg.

Alpha (%)	4.0-6.0
Beta (%)	5.0-6.7
Cohumulone (% of Alpha Acids)	20-26
Total Oil (ml/100g)	0.8-2.1
Myrcene (% of Total Oil)	40-65
Humulene (% of Total Oil)	18-24
Caryophyllene (% of Total Oil)	4-8
Farnesene (% of Total Oil)	< 1
Linalool (% of Total Oil)	—
Total Polyphenols (%)	—



DELTA™

Delta™ is a variety released in 2009 from the Hopsteiner hop breeding program. Developed from a cross between a Fuggle mother and a male derived from Cascade. It shows good resistance to downy mildew and moderate resistance to strains of powdery mildew.



WOODY
AROMATIC



CITRUS

Tilled earth, ginger, lime.

Alpha (%)	5.5-7.0
Beta (%)	5.5-7.0
Cohumulone (% of Alpha Acids)	22-24
Total Oil (ml/100g)	0.5-1.1
Myrcene (% of Total Oil)	25-40
Humulene (% of Total Oil)	30-40
Caryophyllene (% of Total Oil)	9-15
Farnesene (% of Total Oil)	< 1
Linalool (% of Total Oil)	—
Total Polyphenols (%)	—



DR. RUDI

This triploid variety was previously released by the New Zealand Horticultural Research Centre as “Super Alpha” in 1976. It was renamed Dr. Rudi in 2012 to honor the New Zealand breeder/horticulturist who is considered the father of New Zealand’s hop program. The variety was once classified “super” alpha, but by today’s standards, it’s moderate. Dr. Rudi was derived from a Smoothcone mother and open pollination.



WOODY
AROMATIC



CITRUS

Pine resin, lime pith, lemongrass.

Alpha (%)	10-12
Beta (%)	7-8.5
Cohumulone (% of Alpha Acids)	33
Total Oil (ml/100g)	1.3
Myrcene (% of Total Oil)	29.2
Humulene (% of Total Oil)	33.2
Caryophyllene (% of Total Oil)	10.1
Farnesene (% of Total Oil)	0.5
Linalool (% of Total Oil)	—
Total Polyphenols (%)	—



EAST KENT GOLDING (EKG)

East Kent Golding was developed from a wild Canterbury Whitebine variety in late 1700s. Kent is a region in England, home to Canterbury, where this variety was brought to the market in 1790. Recognized as having the most typical English aroma with the best flavor, historically coming from East Kent.



CITRUS



VEGETAL



SPICY

WOODY
AROMATIC

Citrus, artichoke, gingerbread, woodruff.

Alpha (%)	4-6
Beta (%)	1.9-3
Cohumulone (% of Alpha Acids)	25-30
Total Oil (ml/100g)	0.4-0.8
Myrcene (% of Total Oil)	25
Humulene (% of Total Oil)	36
Caryophyllene (% of Total Oil)	—
Farnesene (% of Total Oil)	<1
Linalool (% of Total Oil)	—
Total Polyphenols (%)	—



ECLIPSE®

04-337-016 c.v.

AUSTRALIA

A new, big-hitting flavor hop bursting with sweet mandarin, zesty citrus peel and fresh pine needles. Eclipse® 04-337-016 c.v. was created by the Hop Products Australia (HPA) breeding program in 2004 and commercialized in 2020. Its ancestry is a cross pollination of high alpha Australian and North American hops.



CITRUS



WOODY
AROMATIC

Sweet mandarin, citrus peel, fresh pine needles.

Alpha (%)	15.7-17.9
Beta (%)	5.9-9.0
Cohumulone (% of Alpha Acids)	33-37
Total Oil (ml/100g)	1.7-1.9
Myrcene (% of Total Oil)	35.5-49.0
Humulene (% of Total Oil)	0.6-1.6
Caryophyllene (% of Total Oil)	6.1-12.1
Farnesene (% of Total Oil)	0.2
Linalool (% of Total Oil)	0.6
Total Polyphenols (%)	—



EKUANOT®

HBC 366 c.v.

Ekuanot® HBC 366 c.v. was commercially released in 2014 as “Equinox” by the Hop Breeding Company (HBC) in Yakima. It was subsequently renamed due to trademark issues. The variety has high alpha acids and essential oil content and is known for its vibrant yellow color during its early growth in the spring. The diversified and pronounced aroma characteristics, extremely high oil content, and tight cone structure makes Ekuanot a very unique hop variety.



GREEN-GRASSY



SWEET FRUIT



CITRUS



FLORAL

Green pepper, papaya, lime, apple blossom.

Alpha (%)	14.5-15.5
Beta (%)	4.5-5.5
Cohumulone (% of Alpha Acids)	32-38
Total Oil (ml/100g)	2.5-4.5
Myrcene (% of Total Oil)	30-45
Humulene (% of Total Oil)	12-20
Caryophyllene (% of Total Oil)	8-12
Farnesene (% of Total Oil)	< 1
Linalool (% of Total Oil)	—
Total Polyphenols (%)	—



EL DORADO®

El Dorado® was released by CLS Farms, LLC of Moxee, Washington in 2010. Little information is available about its pedigree, but it is believed to be derived from a *neomexicanus* subspecies of *Humulus lupulus*.



CITRUS

GREEN
FRUITSWEET
FRUIT

Mandarin, pear, apricot, watermelon, wintergreen.

Alpha (%)	13-17
Beta (%)	6.4-8.0
Cohumulone (% of Alpha Acids)	28-33
Total Oil (ml/100g)	2.5-3.3
Myrcene (% of Total Oil)	55-60
Humulene (% of Total Oil)	10-15
Caryophyllene (% of Total Oil)	6-8
Farnesene (% of Total Oil)	0-1
Linalool (% of Total Oil)	—
Total Polyphenols (%)	—



ELIXIR

Elixir is a new and exciting hop variety developed in the legendary growing region of Alsace, France. It was developed through the Comptoir Agricole breeding program in France. Elixir possesses moderate alpha and has a complex fruity aroma.



SPICY



CITRUS

BERRY &
CURRANT

FLORAL

WOODY
AROMATIC

Pepper, orange, strawberry, jasmine, sandalwood.

Alpha (%)	4.6-6.5
Beta (%)	5.8-6.6
Cohumulone (% of Alpha Acids)	26-27.4
Total Oil (ml/100g)	1.85
Myrcene (% of Total Oil)	65.5
Humulene (% of Total Oil)	1.4
Caryophyllene (% of Total Oil)	2.15
Farnesene (mg/100g)	1-2
Linalool (mg/100g)	6
Total Polyphenols (%)	—



ELLA™

01-220-060 c.v.

Ella™ 01-220-060 c.v. is a versatile hop developed through the Hop Products Australia (HPA) breeding program. It grows vigorously, producing moderately large, dense cones.



SWEET
FRUIT



SPICY

Cantaloupe, mango, anise.

Alpha (%)	13.4-19.2
Beta (%)	5.2-7.5
Cohumulone (% of Alpha Acids)	33.0-40.0
Total Oil (ml/100g)	1.2-2.3
Myrcene (% of Total Oil)	34-40
Humulene (% of Total Oil)	16-19
Caryophyllene (% of Total Oil)	5.9-14.1
Farnesene (% of Total Oil)	0.1-0.5
Linalool (% of Total Oil)	0.4-0.6
Total Polyphenols (%)	—



ENDEAVOUR

Endeavour is a dwarf variety bred from a cross made in 2002 between a seedling of Cascade and a granddaughter of Target. This variety imparts unique English flavor notes.



BERRY &
CURRANT



SPICY



CITRUS



SWEET
FRUIT

Blackberry, gingerbread, bergamot, lemon, watermelon.

Alpha (%)	8-10.5
Beta (%)	3.8-5.3
Cohumulone (% of Alpha Acids)	30-36
Total Oil (ml/100g)	1.1-1.7
Myrcene (% of Total Oil)	27-37
Humulene (% of Total Oil)	3-10
Caryophyllene (% of Total Oil)	—
Farnesene (% of Total Oil)	5-8
Linalool (% of Total Oil)	—
Total Polyphenols (%)	—



ENIGMA®

02-016-008 c.v.

AUSTRALIA

Enigma® 02-016-008 c.v. was created by the Hop Products Australia (HPA) breeding program in 2002 and commercialized in 2013. Its ancestry is a cross pollination of Swiss Tettninger and North American hops. Even though Enigma is a direct descendant of Swiss Tettninger, its range of flavors are more characteristic of its North American hop lineage.



GREEN
FRUIT



SWEET
FRUIT



BERRY &
CURRANT

White wine grape, cantaloupe, raspberry, red currant.

Alpha (%)	16.7-19.4
Beta (%)	5.2-7.1
Cohumulone (% of Alpha Acids)	37-43
Total Oil (ml/100g)	1.9-2.8
Myrcene (% of Total Oil)	23-30
Humulene (% of Total Oil)	12-19
Caryophyllene (% of Total Oil)	6-8
Farnesene (% of Total Oil)	9-11
Linalool (% of Total Oil)	0.1-0.5
Total Polyphenols (%)	—



EUREKA!™

Eureka!™, formerly known as Experimental Hop 05256 c.v., is a variety developed by the Hopsteiner hop breeding program. Its pedigree includes Apollo and Merkur. This hop produces a very high alpha content approaching 20%.



BERRY &
CURRANT



HERBAL



WOODY
AROMATIC

Black currant, blackberry, strong tea, pine resin.

Alpha (%)	17.0-19.9
Beta (%)	4.6-6.0
Cohumulone (% of Alpha Acids)	28-30
Total Oil (ml/100g)	2.5-4.4
Myrcene (% of Total Oil)	—
Humulene (% of Total Oil)	—
Caryophyllene (% of Total Oil)	—
Farnesene (% of Total Oil)	—
Linalool (% of Total Oil)	0.6-1.0
Total Polyphenols (%)	4.5-5.0



EXTRA STYRIAN DANA

Extra Syrian Dana is also known as Dana. It was bred from German Hallertauer Magnum and Slovenian genetic hop material at the Slovenian Institute of Hop Research and Brewing. The variety gives good agronomic yields and bitter potential.



SPICY



CITRUS



VEGETAL



GREEN
FRUIT

Juniper, orange, wild garlic, pear.

Alpha (%)	12.5-18.8
Beta (%)	4.2-6.0
Cohumulone (% of Alpha Acids)	30-34
Total Oil (ml/100g)	2.4-3.9
Myrcene (% of Total Oil)	42-60
Humulene (% of Total Oil)	15-22
Caryophyllene (% of Total Oil)	6-8
Farnesene (% of Total Oil)	6-9
Linalool (% of Total Oil)	0.5-1.0
Total Polyphenols (%)	—



FIRST GOLD

First Gold is a dwarf variety derived from a daughter of Whitbread Golding and a male dwarf variety.

It is used as both a general kettle hop and also for late and dry-hopping in all types of beer.

First Gold has excellent aroma qualities and much of the flavor character of Whitbread Golding seems to have been retained.



HERBAL

BERRY &
CURRANTCREAM
CARAMEL

CITRUS

Marjoram, strawberry, yogurt, orange marmalade.

Alpha (%)	6.5-10
Beta (%)	3-4.5
Cohumulone (% of Alpha Acids)	32-35
Total Oil (ml/100g)	0.7-1.7
Myrcene (% of Total Oil)	30-38
Humulene (% of Total Oil)	20
Caryophyllene (% of Total Oil)	—
Farnesene (% of Total Oil)	1.5-3
Linalool (% of Total Oil)	—
Total Polyphenols (%)	—



FUGGLE

Named after the Kent grower that introduced it in 1875, Fuggle has been revered ever since as the classic aroma hop for British Bitters and Pale Ales. The variety is often used in combination with Golding. Fuggle has typical English aroma whose robust character contributes nicely to beer flavor. Sometimes it is used as a distinctive dry hop.



WOODY
AROMATIC



FLORAL



MENTHOL

Potting soil, tobacco, floral, spearmint.

Alpha (%)	3.5-6.5
Beta (%)	2-4
Cohumulone (% of Alpha Acids)	27-33
Total Oil (ml/100g)	0.7-1.1
Myrcene (% of Total Oil)	25-30
Humulene (% of Total Oil)	30-38
Caryophyllene (% of Total Oil)	—
Farnesene (% of Total Oil)	6-8
Linalool (% of Total Oil)	—
Total Polyphenols (%)	—



GALAXY®

94-203-008 c.v.

Galaxy® 94-203-008 c.v. was created by the Hop Products Australia (HPA) breeding program in 1994 and commercialized in 2009. Its ancestry is a cross pollination of high alpha Australian and Perle hops. Galaxy is a late maturing seedless cultivar.

SWEET
FRUIT

CITRUS

Passion fruit, peach, complex citrus.

Alpha (%)	13.0-18.5
Beta (%)	6.1-11.6
Cohumulone (% of Alpha Acids)	32-43
Total Oil (ml/100g)	1.9-2.9
Myrcene (% of Total Oil)	32-56
Humulene (% of Total Oil)	0.8-2.2
Caryophyllene (% of Total Oil)	7.0-14.7
Farnesene (% of Total Oil)	2.8-5.1
Linalool (% of Total Oil)	0.5-1.0
Total Polyphenols (%)	—



GALENA

The name Galena is from the ancient Roman term for the mineral galenite which occurs in the soils of Oregon. Galena, a daughter of Brewers Gold, was developed by the United States Department of Agriculture (USDA) breeding program in Idaho and released in 1978.



CITRUS

SWEET
FRUITGREEN-
GRASSY

Grapefruit, white peach, alfalfa.

Alpha (%)	11.5-13.5
Beta (%)	7.2-8.7
Cohumulone (% of Alpha Acids)	36-40
Total Oil (ml/100g)	0.9-1.3
Myrcene (% of Total Oil)	55-60
Humulene (% of Total Oil)	10-13
Caryophyllene (% of Total Oil)	3-5
Farnesene (% of Total Oil)	< 1
Linalool (% of Total Oil)	—
Total Polyphenols (%)	—



GLACIER

Glacier is a hop with well balanced bittering properties and a pleasant aroma profile. It was released from the Washington State University United States Department of Agriculture (USDA) breeding program in 2000. The variety was selected for its low cohumulone content and good yield potential. Glacier is a daughter of French Strisselspalt.



HERBAL



CITRUS

WOODY
AROMATIC

Sage, rosemary, fresh ginger, cedar.

Alpha (%)	3.3-9.7
Beta (%)	5.4-9.7
Cohumulone (% of Alpha Acids)	11-13
Total Oil (ml/100g)	0.7-1.6
Myrcene (% of Total Oil)	33-62
Humulene (% of Total Oil)	24-36
Caryophyllene (% of Total Oil)	6-10
Farnesene (% of Total Oil)	< 1
Linalool (% of Total Oil)	—
Total Polyphenols (%)	—



GOLDING

U.S. Golding is the descendant of the well-known English variety, East Kent Golding. It was first cultivated in British Columbia and then made its way to Washington State and Oregon in the early 1990s. There are agronomic challenges in growing Golding, but the “typical” English aroma profile continues to fuel demand for this hop.



CREAM
CARAMEL



SPICY



FLORAL

Honey, cardamom, sweet pea.

Alpha (%)	4-6
Beta (%)	2-3
Cohumulone (% of Alpha Acids)	25-28
Total Oil (ml/100g)	0.4-1.0
Myrcene (% of Total Oil)	25-35
Humulene (% of Total Oil)	35-45
Caryophyllene (% of Total Oil)	13-16
Farnesene (% of Total Oil)	—
Linalool (% of Total Oil)	—
Total Polyphenols (%)	—



HALLERTAU BLANC

Hallertau Blanc is a German variety bred at Hüll and is a daughter of Cascade. It was released in 2012 as one of the varieties which have been bred and commercialized in response to demand from the craft beer industry's desire for bold tastes and differentiating flavors.



GREEN
FRUIT



BERRY &
CURRANT



CITRUS

White grapes, cassis, lemongrass, grapefruit.

Alpha (%)	9.0-11.0
Beta (%)	4.0-7.0
Cohumulone (% of Alpha Acids)	22-26
Total Oil (ml/100g)	1.5-1.8
Myrcene (% of Total Oil)	70
Humulene (% of Total Oil)	0-3
Caryophyllene (% of Total Oil)	0-2
Farnesene (% of Total Oil)	<1
Linalool (% of Total Oil)	—
Total Polyphenols (%)	3-5.9



HALLERTAUER MAGNUM

GERMANY

This high alpha variety was bred in 1980 at Hüll Hop Research Center in Germany. Hallertauer Magnum is known for its extremely large and heavy cones. It produces good yields, and like many of the Hüll varieties, Hallertauer Magnum has a high tolerance to disease. The hop is a daughter of U.S. Galena.



CITRUS



GREEN-GRASSY



MENTHOL



GREEN FRUIT

Lemon, green pepper, spearmint, apple.

Alpha (%)	11-16
Beta (%)	5-7
Cohumulone (% of Alpha Acids)	21-29
Total Oil (ml/100g)	1.6-2.6
Myrcene (% of Total Oil)	30-45
Humulene (% of Total Oil)	30-45
Caryophyllene (% of Total Oil)	8-12
Farnesene (% of Total Oil)	< 1
Linalool (% of Total Oil)	0.2-0.7
Total Polyphenols (%)	2-3



HALLERTAUER MITTELFRÜH

This is a classic German landrace variety with fine aroma and low bitter content. Because of its high susceptibility to wilt, Hallertauer Mittelfrüh had suffered from a dramatic decrease in cultivation in the 1990s. However, the introduction of virus-free plant material has improved the agronomics of this cultivar.



HERBAL



FLORAL

WOODY
AROMATIC

Sage, rosemary, lavender, pine.

Alpha (%)	3.0-5.5
Beta (%)	3.0-5.0
Cohumulone (% of Alpha Acids)	18-28
Total Oil (ml/100g)	0.7-1.3
Myrcene (% of Total Oil)	20-28
Humulene (% of Total Oil)	45-55
Caryophyllene (% of Total Oil)	10-15
Farnesene (% of Total Oil)	< 1
Linalool (% of Total Oil)	0.7-1.1
Total Polyphenols (%)	4.0-5.0



HALLERTAUER TAURUS

GERMANY

Released in 1995, Hallertauer Taurus is a high alpha German variety bred at the Hüll Research Center. It has a noble, aromatic bitter quality with small and very compact cones which allows clean, mechanical picking and easy drying of the hop.



SPICY



SWEET
FRUIT



CREAM
CARAMEL

Pepper, ripe banana, chocolate.

Alpha (%)	12.0-17.0
Beta (%)	4-6
Cohumulone (% of Alpha Acids)	20-25
Total Oil (ml/100g)	0.9-1.4
Myrcene (% of Total Oil)	30-50
Humulene (% of Total Oil)	23-33
Caryophyllene (% of Total Oil)	6-11
Farnesene (% of Total Oil)	< 1
Linalool (% of Total Oil)	1.0-1.5
Total Polyphenols (%)	3-4



HARMONIE

Harmonie was registered in 2004 and has a high beta to alpha relative content. Current acreage is limited but it has shown very good quality for its contribution to pilsner beer aroma in Czechia. Its name comes from the “harmonious structure of hop resins.”



SWEET
FRUIT



CREAM
CARAMEL



HERBAL

Banana, apricot, crème caramel, green tea.

Alpha (%)	5.0-8.0
Beta (%)	5.0-8.0
Cohumulone (% of Alpha Acids)	17-21
Total Oil (ml/100g)	1.0-2.0
Myrcene (% of Total Oil)	30-45
Humulene (% of Total Oil)	15-25
Caryophyllene (% of Total Oil)	6-11
Farnesene (% of Total Oil)	<1.0
Linalool (% of Total Oil)	0.7-1.2
Total Polyphenols (%)	3.5-4.5



HBC 472 c.v.

HBC 472 c.v. has a special flavor profile that has generated interest amongst brewers. This experimental hop cultivar from the Hop Breeding Company (HBC) touts a combination of cream, vanilla, and wood flavor, along with citrus. In beer, the flavor has been described as “coconut,” “barrel aged,” and “whiskey.” HBC 472 c.v. can be used in a myriad of beer styles, because its flavor synergizes well with both malt flavors and hop flavors.



WOODY
AROMATIC



CREAM
CARAMEL



CITRUS

Oak, bourbon barrel, coconut, vanilla, orange.

Alpha (%)	7.0-10.0
Beta (%)	7.0-9.0
Cohumulone (% of Alpha Acids)	—
Total Oil (ml/100g)	1.5-2.5
Myrcene (% of Total Oil)	35-45
Humulene (% of Total Oil)	1-5
Caryophyllene (% of Total Oil)	25-30
Farnesene (% of Total Oil)	4-6
Linalool (% of Total Oil)	0-1
Total Polyphenols (%)	—



HBC 522 c.v.

HBC 522 c.v. is an experimental hop cultivar first bred by the Hop Breeding Company (HBC) in 2006. It is a cross between a female Columbus and an experimental male 986-2 c.v. HBC 522 c.v. has been described as similar to Centennial and Cascade, with a mix of floral, citrus (especially orange and grapefruit), and pine needles.



CITRUS



FLORAL

WOODY
AROMATIC

Bitter orange, grapefruit, jasmine, pine needles.

Alpha (%)	9.5-12
Beta (%)	4.5-5.5
Cohumulone (% of Alpha Acids)	22-26
Total Oil (ml/100g)	1.4-2.3
Myrcene (% of Total Oil)	36.9
Humulene (% of Total Oil)	13.2
Caryophyllene (% of Total Oil)	8.44
Farnesene (% of Total Oil)	0.52
Linalool (% of Total Oil)	0.64
Total Polyphenols (%)	—



HBC 586 c.v.

HBC 586 c.v. is an experimental hop cultivar developed by the Hop Breeding Company (HBC). It was bred via a hybrid pollination of two experimental hop varieties. When used as a whirlpool addition or dry-hop addition, HBC 586 c.v. delivers a large medley of fruit flavors associated with tropical fruits. The fruity flavors of HBC 586 c.v. has been described as mango, guava, lychee, citrus, with slight sulfur and herbal notes. Many find HBC 586 c.v. to have fruit flavors that are special and new to the world of hops.



SWEET
FRUIT



BERRY &
CURRANT



SPICY



CITRUS

**Fruit salad, mango, lychee, berries,
fresh-cut pepper, mandarin orange.**

Alpha (%)	12.0-13.0
Beta (%)	7.5-8.5
Cohumulone (% of Alpha Acids)	38-41
Total Oil (ml/100g)	1.2-2.5
Myrcene (% of Total Oil)	40-50
Humulene (% of Total Oil)	14-22
Caryophyllene (% of Total Oil)	7-15
Farnesene (% of Total Oil)	0-1
Linalool (% of Total Oil)	0-1
Total Polyphenols (%)	—



HBC 630 c.v.

HBC 630 c.v. is an experimental hop cultivar developed by the Hop Breeding Company (HBC). It was bred from a 2008 cross between two experimental hop varieties.

HBC 630 c.v. is complex and fruity, with sweet fruit (cherry) and berry (raspberry) character. In addition, sweet candy-like esters and lactones combine to give creamy notes of banana and peaches.



SWEET
FRUIT



BERRY &
CURRANT



CREAM
CARAMEL

**Cherry, banana, peach, raspberry jam,
crème caramel, coconut.**

Alpha (%)	13.6-14.0
Beta (%)	5.6-6.3
Cohumulone (% of Alpha Acids)	22-26
Total Oil (ml/100g)	2.5-3.0
Myrcene (% of Total Oil)	—
Humulene (% of Total Oil)	—
Caryophyllene (% of Total Oil)	—
Farnesene (% of Total Oil)	—
Linalool (% of Total Oil)	—
Total Polyphenols (%)	—



HBC 1019 c.v.

HBC 1019 c.v. is an experimental hop cultivar bred by the Hop Breeding Company (HBC). It arose from a 2016 cross between two HBC developmental varieties. Agronomically, it is a high yielding cultivar with a desirable early harvest window. HBC 1019 c.v. has a potent but pleasing mix of citrus, tropical and stone fruits. With notes of coconut, Valencia oranges, caramelized bananas, peaches, and honeydew melon, HBC 1019 c.v. is reminiscent of dark rum and daiquiris.



SWEET
FRUIT



CITRUS



CREAM
CARAMEL

**Honeydew melon, peaches, tropical fruit,
candy, coconut, orange.**

Alpha (%)	10-12
Beta (%)	8-9
Cohumulone (% of Alpha Acids)	22-24
Total Oil (ml/100g)	1.3-2.2
Myrcene (% of Total Oil)	38.9
Humulene (% of Total Oil)	10.6
Caryophyllene (% of Total Oil)	7.2
Farnesene (% of Total Oil)	0.4
Linalool (% of Total Oil)	0.5
Total Polyphenols (%)	—



HERKULES

True to its name, Herkules is a robust, high-yielding, high bittering hop cultivar tolerant to various diseases. As a daughter of Hallertauer Taurus it was released in 2006 by the Hüll Hop Research Center.

Herkules has excellent brewing quality combined with very good storage stability.



CITRUS

SWEET
FRUIT

MENTHOL

**Orange, lemongrass, honeydew melon,
lemon balm, peppermint.**

Alpha (%)	12.0-17.0
Beta (%)	4.0-5.5
Cohumulone (% of Alpha Acids)	32-38
Total Oil (ml/100g)	1.6-2.4
Myrcene (% of Total Oil)	30-50
Humulene (% of Total Oil)	30-45
Caryophyllene (% of Total Oil)	7-12
Farnesene (% of Total Oil)	<1
Linalool (% of Total Oil)	0.3-0.8
Total Polyphenols (%)	3-4



HERSBRUCKER

This traditional German variety, also known as Hersbrucker Spät, is from the Hersbrucker growing area. It was once considered a successor to Hallertauer Mittelfrüh. This hop exhibits a fine noble aroma but sometimes displays a very low alpha content. Hersbrucker has good tolerance to diseases.



MENTHOL



CITRUS



HERBAL

Lemon balm, orange, black tea, marjoram.

Alpha (%)	1.5-4.0
Beta (%)	2.5-6.0
Cohumulone (% of Alpha Acids)	17-25
Total Oil (ml/100g)	0.5-1.0
Myrcene (% of Total Oil)	15-30
Humulene (% of Total Oil)	20-30
Caryophyllene (% of Total Oil)	8-13
Farnesene (% of Total Oil)	< 1
Linalool (% of Total Oil)	0.5-1.0
Total Polyphenols (%)	5-6



HORIZON

A diploid high alpha hop, Horizon was a United States Department of Agriculture (USDA) selection of a cross made in Oregon in 1970 and released in 1997. It is a half sister of Nugget with a breeding line that includes Brewers Gold, Early Green hops and a United States Department of Agriculture (USDA) experimental variety. It is notably low in cohumulone with high myrcene content.



FLORAL

WOODY
AROMATIC

CITRUS

Lilac, pine resin, fresh-cut ginger.

Alpha (%)	10.2-16.5
Beta (%)	4.6-9.0
Cohumulone (% of Alpha Acids)	17-22
Total Oil (ml/100g)	1.25-2.60
Myrcene (% of Total Oil)	60-70
Humulene (% of Total Oil)	8-10
Caryophyllene (% of Total Oil)	5-6
Farnesene (% of Total Oil)	2
Linalool (% of Total Oil)	—
Total Polyphenols (%)	—



HÜLL MELON

Hüll Melon is one of the German varieties released in 2012. It was bred from a Cascade mother at the Hüll Hop Research Center. It is one of the recent cultivars bred and commercialized in response to demand from the craft beer industry's desire for bold tastes and differentiating flavors.



SWEET
FRUIT



BERRY &
CURRANT



FLORAL



SPICY

Melon, peach tea, strawberry, geranium, aniseed.

Alpha (%)	7-8
Beta (%)	6-8
Cohumulone (% of Alpha Acids)	25-30
Total Oil (ml/100g)	0.8-2.1
Myrcene (% of Total Oil)	26-42
Humulene (% of Total Oil)	10-20
Caryophyllene (% of Total Oil)	5-10
Farnesene (% of Total Oil)	< 1
Linalool (% of Total Oil)	0.2-0.3
Total Polyphenols (%)	3.0-4.6



IDAHO 7™

Idaho 7™ was originally known as 007 The Golden Hop. The cultivar has high alpha content and also contributes desirable flavor attributes to beer. It was released in 2015 by Jackson Hop Farm in Wilder, ID.



SWEET
FRUIT



WOODY
AROMATIC



CITRUS

Guava, apricot, pine resin, lemon, orange pith.

Alpha (%)	13-15
Beta (%)	4-5
Cohumulone (% of Alpha Acids)	30-40
Total Oil (ml/100g)	1.0-1.6
Myrcene (% of Total Oil)	45-55
Humulene (% of Total Oil)	10-20
Caryophyllene (% of Total Oil)	5-10
Farnesene (% of Total Oil)	—
Linalool (% of Total Oil)	0.5-1.0
Total Polyphenols (%)	—



IDAHO GEM™

Idaho Gem™ was found and is marketed by Idaho's Gooding Farms. This varietal has relatively high alpha and levels of sweet fruity flavor.



SWEET
FRUIT



CITRUS



HERBAL

Pineapple, cherry candy, grapefruit, green tea.

Alpha (%)	11-14
Beta (%)	5-7
Cohumulone (% of Alpha Acids)	40-45
Total Oil (ml/100g)	1-3
Myrcene (% of Total Oil)	50-60
Humulene (% of Total Oil)	16-20
Caryophyllene (% of Total Oil)	4-6
Farnesene (% of Total Oil)	0.1-1
Linalool (% of Total Oil)	—
Total Polyphenols (%)	—



IUNGA

Iunga was released in 2004 from the Institute of Soil Science and Plant Cultivation (IUNG) in Pulawy, Poland as a high alpha variety. There is disagreement in its pedigree in that some reports have it bred from Northern Brewer and Marynka, yet others say it's a cross between Lubelski and a Yugoslavian male hop.



SWEET
FRUIT



CITRUS



CREAM
CARAMEL

Pineapple, peach, citrus, honey.

Alpha (%)	8-12.5
Beta (%)	5-7
Cohumulone (% of Alpha Acids)	29-34
Total Oil (ml/100g)	1.5-2.5
Myrcene (% of Total Oil)	40-55
Humulene (% of Total Oil)	30-40
Caryophyllene (% of Total Oil)	8-11
Farnesene (% of Total Oil)	< 1
Linalool (% of Total Oil)	—
Total Polyphenols (%)	—



IZABELLA

Izabella was developed in the late 1980s from a cross of Lubelski and a Yugoslavian male hop. The cross was initially targeted as a high alpha variety, but because of its low bittering potential, the cultivar languished for years. However, the craft beer boom and Izabella's aroma character has resurrected the variety.



CITRUS

WOODY
AROMATIC

Generic citrus, pine.

Alpha (%)	4.7-6.0
Beta (%)	2-3
Cohumulone (% of Alpha Acids)	—
Total Oil (ml/100g)	1.3
Myrcene (% of Total Oil)	54.4
Humulene (% of Total Oil)	18
Caryophyllene (% of Total Oil)	8.7
Farnesene (% of Total Oil)	—
Linalool (% of Total Oil)	—
Total Polyphenols (%)	—



JARRYLO®

ADHA 881 c.v.

Jarrylo® (pronounced Jar-ril-low) ADHA 881 c.v. was developed and released by the Association for the Development of Hop Agronomy (ADHA). The name is derived from the Slavic god of fertility and springtime. Her mother is Summit and the father is ADHA 75-2 c.v.



SWEET
FRUIT



CITRUS



SPICY

Overripe banana, pear, orange, allspice.

Alpha (%)	15-17
Beta (%)	6.0-7.5
Cohumulone (% of Alpha Acids)	34-37
Total Oil (ml/100g)	3.6-4.3
Myrcene (% of Total Oil)	40-55
Humulene (% of Total Oil)	15-18
Caryophyllene (% of Total Oil)	8-11
Farnesene (% of Total Oil)	< 1
Linalool (% of Total Oil)	—
Total Polyphenols (%)	—



KAZBEK

Kazbek was a selection from hybrid progenies of breeding material originating from Russian wild hops. Released in 2008, the name Kazbek is from the highest peak within the middle of the Caucasus mountain range in Czechia.



CITRUS

SWEET
FRUITBERRY &
CURRANTCREAM
CARAMEL

Orange, peach, passion fruit, raspberry, chocolate.

Alpha (%)	5.0-8.0
Beta (%)	4.0-6.0
Cohumulone (% of Alpha Acids)	35-40
Total Oil (ml/100g)	0.9-1.8
Myrcene (% of Total Oil)	40-55
Humulene (% of Total Oil)	20-35
Caryophyllene (% of Total Oil)	10-15
Farnesene (% of Total Oil)	< 1.0
Linalool (% of Total Oil)	0.3-0.5
Total Polyphenols (%)	3.5-4.5



LEMON DROP™

Lemon Drop™ (previously known as Experimental 01210 c.v.) is a distinctive variety developed through the Hopsteiner hop breeding program. It was derived from a Cascade mother and USDA 19058 c.v. father.

Lemon Drop has an alpha content similar to Cascade.



CITRUS



MENTHOL



HERBAL

SWEET
FRUIT

Lemon, mint, green tea, subtle melon.

Alpha (%)	5.0-7.0
Beta (%)	4.0-6.0
Cohumulone (% of Alpha Acids)	28-34
Total Oil (ml/100g)	1.5-2.0
Myrcene (% of Total Oil)	—
Humulene (% of Total Oil)	—
Caryophyllene (% of Total Oil)	—
Farnesene (% of Total Oil)	6-7
Linalool (% of Total Oil)	0.4-0.6
Total Polyphenols (%)	4.0-4.5



LIBERTY

Liberty is a triploid variety bred from a cross between a female Hallertauer Mittelfrüh and a downy mildew resistant German male hop. The cultivar was bred in 1983 at the United States Department of Agriculture (USDA) program at Oregon State University and released in the U.S. in 1991. Of the four U.S. triploid Hallertau varieties released during that time, Liberty most closely resembles Hallertauer Mittelfrüh.



FLORAL



CITRUS

WOODY
AROMATIC

Delicate floral, lemon, myrrh.

Alpha (%)	3-5
Beta (%)	3-4
Cohumulone (% of Alpha Acids)	24-30
Total Oil (ml/100g)	0.6-1.2
Myrcene (% of Total Oil)	20-40
Humulene (% of Total Oil)	35-40
Caryophyllene (% of Total Oil)	9-12
Farnesene (% of Total Oil)	< 1
Linalool (% of Total Oil)	—
Total Polyphenols (%)	—



LORAL®

HBC 291 c.v.

Loral® HBC 291 c.v. was bred by the Hop Breeding Company (HBC) and released in 2016. Loral's mother is U.S. Glacier and her grandmother the long established French noble aroma variety Tardif de Bourgogne. The father is a son of the Nugget variety. Loral is characterized by having numerous small, dense cones with moderate alpha acids.



FLORAL



HERBAL



CITRUS

Violet, lily, fennel frond, lemon.

Alpha (%)	10-12
Beta (%)	4.5-5.5
Cohumulone (% of Alpha Acids)	21-23
Total Oil (ml/100g)	1.5-2.5
Myrcene (% of Total Oil)	37-39
Humulene (% of Total Oil)	23-25
Caryophyllene (% of Total Oil)	6-8
Farnesene (% of Total Oil)	< 1
Linalool (% of Total Oil)	1.0-1.4
Total Polyphenols (%)	—



LOTUS™

Lotus™ is a variety released by Hopsteiner. It is from a long lineage that starts with Eastern Gold, a Japanese variety, from 1930. A number of different hops were involved in subsequent crosses. These included Apollo, Cascade, a United States Department of Agriculture (USDA) male, and a daughter from the open pollination of a wild *neomexicanus* hop.



CITRUS



CREAM
CARAMEL



BERRY &
CURRANT



SWEET
FRUIT

Orange, vanilla, blackberry, tropical fruits.

Alpha (%)	13.0-17.0
Beta (%)	5.5-6.0
Cohumulone (% of Alpha Acids)	33-39
Total Oil (ml/100g)	1.5-2.5
Myrcene (% of Total Oil)	—
Humulene (% of Total Oil)	—
Caryophyllene (% of Total Oil)	—
Farnesene (% of Total Oil)	—
Linalool (% of Total Oil)	0.2-0.4
Total Polyphenols (%)	—



LUBLIN (LUBELSKI)

Originating from the Saaz hop, this variety is a Pulawy bred variety with very fine aroma characteristics.

Today, Lublin is cultivated in the Polish growing regions of Lublin, Poznan and Opole. It is of average alpha and hectare yield, however, better than that of Saaz. Lublin has a good tolerance to diseases and grows on light to medium heavy soils.



SPICY



CITRUS



FLORAL



HERBAL

Juniper, curry, cinnamon, bergamot, geranium, dill.

Alpha (%)	3.0-4.5
Beta (%)	3-4
Cohumulone (% of Alpha Acids)	25-28
Total Oil (ml/100g)	0.5-1.1
Myrcene (% of Total Oil)	22-29
Humulene (% of Total Oil)	30-40
Caryophyllene (% of Total Oil)	6-11
Farnesene (% of Total Oil)	10-14
Linalool (% of Total Oil)	—
Total Polyphenols (%)	—



MAGNAT

Magnat is a high alpha variety developed by the Institute of Soil Science and Plant Cultivation (IUNG) in Poland and was released in 2012. It is a daughter of German Hallertauer Magnum, from which its name is derived. Magnat has high yields and a favorable late maturity.



CITRUS

WOODY
AROMATIC

FLORAL



HERBAL

Lemon zest, generic woody, chamomile, oregano, chives.

Alpha (%)	11-16
Beta (%)	3-7
Cohumulone (% of Alpha Acids)	—
Total Oil (ml/100g)	1.0-2.0
Myrcene (% of Total Oil)	30-50
Humulene (% of Total Oil)	19
Caryophyllene (% of Total Oil)	7.2
Farnesene (% of Total Oil)	—
Linalool (ul/100g)	11
Total Polyphenols (%)	—



MANDARINA BAVARIA

Mandarina Bavaria is a German hop with a pleasant fruitiness and very distinctive tangerine and citrus notes. The variety is a Cascade daughter which was bred at Hüll and released in 2012.



CITRUS

SWEET
FRUITBERRY &
CURRANT

Lime, lemon, pineapple, strawberry, cassis.

Alpha (%)	7-10
Beta (%)	4-7
Cohumulone (% of Alpha Acids)	31-35
Total Oil (ml/100g)	1.5-2.2
Myrcene (% of Total Oil)	up to 71
Humulene (% of Total Oil)	5-15
Caryophyllene (% of Total Oil)	1-5
Farnesene (% of Total Oil)	< 1
Linalool (% of Total Oil)	up to 0.3
Total Polyphenols (%)	2.3-2.7



MARYNKA

POLAND

Marynka was bred in Poland from a Brewers Gold mother and Slovenian father hop, and registered in 1988. It is also characterized by a very high level of beta acids. Marynka has strong aroma characteristics and good resistance to most pests and diseases.



SPICY



CITRUS



WOODY
AROMATIC

Licorice, aniseed, lemon, grapefruit, earthy.

Alpha (%)	9-12
Beta (%)	10.2-13.0
Cohumulone (% of Alpha Acids)	26-33
Total Oil (ml/100g)	1.8-2.2
Myrcene (% of Total Oil)	28-31
Humulene (% of Total Oil)	26-33
Caryophyllene (% of Total Oil)	11-12
Farnesene (% of Total Oil)	1-3
Linalool (% of Total Oil)	—
Total Polyphenols (%)	—



MCKENZIE™

C-148 c.v.

Commercially launched in 2021, McKenzie™ C-148 c.v. is the first variety released by the West Coast Hop Breeding Company (WCHB) of Aurora, Oregon. WCHB is a co-operative organization of six Oregon growers, founded by Pat Leavy (Oregon Hop House) and Fred Geschwill (F&B Farms). McKenzie was bred specifically for the climate and agronomy of Oregon, maximizing the local terroir. McKenzie is described as a bright and fruity mixture of classic varieties like Fuggle and Centennial.



CITRUS



SWEET
FRUIT



WOODY
AROMATIC



HERBAL

Grapefruit, lemon, nectarine, melon rind, pine resin, thyme.

Alpha (%)	10.3
Beta (%)	8.7
Cohumulone (% of Alpha Acids)	—
Total Oil (ml/100g)	2.3
Myrcene (% of Total Oil)	—
Humulene (% of Total Oil)	—
Caryophyllene (% of Total Oil)	—
Farnesene (% of Total Oil)	—
Linalool (% of Total Oil)	—
Total Polyphenols (%)	—



MEDUSA™

Medusa™ is an aroma hop released by CLS Farms in Washington. It is derived from the *Humulus lupulus neomexicanus* subspecies originating in the New Mexico region. A characteristic of Medusa is the occurrence of multiple heads on its hop cones, hence the name.



SWEET
FRUIT



CITRUS

Guava, melon, apricot, lemon.

Alpha (%)	3
Beta (%)	6.5
Cohumulone (% of Alpha Acids)	—
Total Oil (ml/100g)	0.7
Myrcene (% of Total Oil)	54.6
Humulene (% of Total Oil)	9.1
Caryophyllene (% of Total Oil)	14.0
Farnesene (% of Total Oil)	1.6
Linalool (% of Total Oil)	0.6
Total Polyphenols (%)	—



MERIDIAN®

Meridian® was introduced by Indie Hops in Oregon.

The variety was propagated in 2012 from plant material of unknown origin that showed promising brewing qualities. After evaluations for agronomic stability and disease resistance, it was commercialized as Meridian in 2015.



SWEET
FRUIT



BERRY &
CURRANT



CITRUS



MENTHOL

Tropical fruit, mixed berry, lemon, spearmint.

Alpha (%)	5-6.5
Beta (%)	7-8
Cohumulone (% of Alpha Acids)	50.1
Total Oil (ml/100g)	1.1-1.6
Myrcene (% of Total Oil)	40-64.4
Humulene (% of Total Oil)	9-17.6
Caryophyllene (% of Total Oil)	4-8
Farnesene (% of Total Oil)	< 1
Linalool (% of Total Oil)	—
Total Polyphenols (%)	—



MILLENNIUM®

Millennium® is a high alpha variety developed through the John I. Haas, Inc., breeding program and released in 2000. With Nugget as the mother, this triploid variety exhibits the same powdery mildew resistance as Nugget. Its brewing profile is comparable to that of Nugget and Columbus-type varieties.



WOODY
AROMATIC



FLORAL



CITRUS



MENTHOL

Cedar, tobacco, lilac, lime, lemongrass, sage.

Alpha (%)	14.5-16.5
Beta (%)	4.3-5.3
Cohumulone (% of Alpha Acids)	28-32
Total Oil (ml/100g)	1.8-2.2
Myrcene (% of Total Oil)	30-40
Humulene (% of Total Oil)	23-27
Caryophyllene (% of Total Oil)	9-12
Farnesene (% of Total Oil)	<1
Linalool (% of Total Oil)	—
Total Polyphenols (%)	—



MISTRAL

Mistral is a French variety released by the Comptoir Agricole breeding program in 2016. It has medium alpha content and is recognized for its subtle aroma profile.



CITRUS

SWEET
FRUITGREEN
FRUIT

Orange, melon, muscat.

Alpha (%)	6.5-8.5
Beta (%)	3.1-3.8
Cohumulone (% of Alpha Acids)	30-39
Total Oil (ml/100g)	0.8-1.5
Myrcene (% of Total Oil)	50-65
Humulene (% of Total Oil)	9.5-17.0
Caryophyllene (% of Total Oil)	—
Farnesene (mg/100g)	27-34
Linalool (mg/100g)	4-7
Total Polyphenols (%)	—



MONROE

Monroe is a German-grown hop that was developed from U.S. wild hop lineage. Its red fruit/berry forward character is evocative of the hop's namesake, Marilyn Monroe in a red dress.



SWEET
FRUIT



CITRUS



BERRY &
CURRANT

Morello cherry, orange syrup, raspberry.

Alpha (%)	2.8-2.9
Beta (%)	6.5-7.5
Cohumulone (% of Alpha Acids)	—
Total Oil (ml/100g)	up to 0.95
Myrcene (% of Total Oil)	up to 37
Humulene (% of Total Oil)	—
Caryophyllene (% of Total Oil)	—
Farnesene (% of Total Oil)	—
Linalool (% of Total Oil)	up to 1
Total Polyphenols (%)	4.4-4.8



MOSAIC®

HBC 369 c.v.

Mosaic® HBC 369 c.v. is a hop variety developed by the Hop Breeding Company (HBC) and released in 2012.

Mosaic® is the daughter of Simcoe® YCR 14 c.v. and a Nugget-derived male.



CITRUS



SWEET
FRUIT



BERRY &
CURRANT

Tangerine, lime, peach, passion fruit, blueberry.

Alpha (%)	11.5-13.5
Beta (%)	3.2-3.9
Cohumulone (% of Alpha Acids)	24-26
Total Oil (ml/100g)	1-1.5
Myrcene (% of Total Oil)	47-53
Humulene (% of Total Oil)	13-16
Caryophyllene (% of Total Oil)	5-8
Farnesene (% of Total Oil)	0
Linalool (% of Total Oil)	—
Total Polyphenols (%)	—



MOTUEKA™

Motueka™ is a triploid hop developed at the New Zealand Institute for Plant and Food Research. It is a cross of Saaz and a New Zealand breeding selection.



CITRUS



SWEET
FRUIT



HERBAL

**Lime zest, mojito, lemongrass,
stone fruit nectar, banana, basil.**

Alpha (%)	6.5-7.5
Beta (%)	5.0-5.5
Cohumulone (% of Alpha Acids)	28-30
Total Oil (ml/100g)	0.6-1.0
Myrcene (% of Total Oil)	45-50
Humulene (% of Total Oil)	2-6
Caryophyllene (% of Total Oil)	1-3
Farnesene (% of Total Oil)	10-14
Linalool (% of Total Oil)	—
Total Polyphenols (%)	—



MOUNT HOOD

Mt. Hood is an aroma variety released in 1989 from the United States Department of Agriculture (USDA) breeding program in Oregon. The variety is a triploid daughter of Hallertauer Mittelfrüh and a sister to Liberty.



SPICY



HERBAL



CITRUS

Juniper, tarragon, lemongrass.

Alpha (%)	4-7
Beta (%)	5-8
Cohumulone (% of Alpha Acids)	21-23
Total Oil (ml/100g)	1.2-1.7
Myrcene (% of Total Oil)	30-40
Humulene (% of Total Oil)	30-38
Caryophyllene (% of Total Oil)	13-16
Farnesene (% of Total Oil)	<1
Linalool (% of Total Oil)	0.5-0.7
Total Polyphenols (%)	—



MOUNT RAINIER

Mt. Rainier was released in 2008 through the United States Department of Agriculture (USDA) hop breeding program at Oregon State University. The inspiration for the name came from one of the many active volcanoes that are located in Washington State. It is the daughter of German Hallertauer Magnum and a USDA male hop. The hop combines noble, Hallertau-like aroma characteristics with citrus and licorice notes.



FLORAL



CITRUS



SPICY

Geranium, lilac, lemon, black licorice.

Alpha (%)	5-8.1
Beta (%)	5-7
Cohumulone (% of Alpha Acids)	21-24
Total Oil (ml/100g)	0.2-2.2
Myrcene (% of Total Oil)	47-54
Humulene (% of Total Oil)	9-14
Caryophyllene (% of Total Oil)	4-7
Farnesene (% of Total Oil)	—
Linalool (% of Total Oil)	—
Total Polyphenols (%)	—



MOUTERE™

Moutere™ HORT0605 c.v. is a New Zealand-bred triploid variety developed at the New Zealand Institute for Plant and Food Research. It was bred from the cross of a New Zealand variety Southern Cross with a selected New Zealand male. Moutere was commercially released in 2015.



SWEET
FRUIT



CITRUS

Tropical fruits, passion fruit, grapefruit.

Alpha (%)	17.5-19.5
Beta (%)	8.0-10.0
Cohumulone (% of Alpha Acids)	26
Total Oil (ml/100g)	1.7
Myrcene (% of Total Oil)	22.2
Humulene (% of Total Oil)	15.2
Caryophyllene (% of Total Oil)	5.8
Farnesene (% of Total Oil)	0.3
Linalool (% of Total Oil)	—
Total Polyphenols (%)	—



NELSON SAUVIN™

Nelson Sauvín™ is a triploid variety developed through the HortResearch hop breeding program in New Zealand. It was bred from the New Zealand variety Smoothcone and released in 2000.



GREEN
FRUIT



CITRUS



SWEET
FRUIT

White wine, gooseberry, grapefruit, mango, lychee, melon.

Alpha (%)	12-13
Beta (%)	6-8
Cohumulone (% of Alpha Acids)	22-26
Total Oil (ml/100g)	1.0-1.2
Myrcene (% of Total Oil)	21-23
Humulene (% of Total Oil)	35-37
Caryophyllene (% of Total Oil)	10-12
Farnesene (% of Total Oil)	< 1
Linalool (% of Total Oil)	—
Total Polyphenols (%)	—



NEWPORT

Newport, released in 2002, was developed through the United States Department of Agriculture (USDA) program at Oregon State University. This cultivar possesses high alpha and beta acid levels. It is a descendant from a cross of Hallertauer Magnum and USDA male 58111 c.v. Newport has excellent yields and is resistant to both powdery and downy mildews.



CITRUS

WOODY
AROMATIC

Generic citrus, leather, balsamic.

Alpha (%)	13.5-17
Beta (%)	7.2-9.1
Cohumulone (% of Alpha Acids)	36-38
Total Oil (ml/100g)	1.6-3.4
Myrcene (% of Total Oil)	47-54
Humulene (% of Total Oil)	9-14
Caryophyllene (% of Total Oil)	1-7
Farnesene (% of Total Oil)	0-1
Linalool (% of Total Oil)	—
Total Polyphenols (%)	—



NORTHERN BREWER

Northern Brewer was an English hop that was bred in 1934. Its pedigree can be traced to a cross between a female American wild hop and an English father. Today, Northern Brewer is grown in the U.S., U.K., and Germany with Germany being the primary growing region.



WOODY
AROMATIC



MENTHOL

Pine, tobacco, lemon balm.

Alpha (%)	8-10
Beta (%)	3-5
Cohumulone (% of Alpha Acids)	27-33
Total Oil (ml/100g)	1.5-2
Myrcene (% of Total Oil)	25-45
Humulene (% of Total Oil)	35-50
Caryophyllene (% of Total Oil)	10-20
Farnesene (% of Total Oil)	<1
Linalool (% of Total Oil)	—
Total Polyphenols (%)	—



NUGGET

Nugget is a high alpha variety originally developed through the United States Department of Agriculture (USDA) program at Oregon State University. The cross was initially made in 1970 but ended up being registered much later in 1984. The cultivar is tolerant to a wide range of soil conditions and thus grows vigorously in all areas. Nugget is also grown in the German Hallertau region but produces somewhat lower alpha content there. Nugget is a daughter of Brewers Gold.



HERBAL



CITRUS

SWEET
FRUITWOODY
AROMATIC

**Fresh-crushed herbs, grapefruit zest,
stone fruit, pineapple, resin.**

Alpha (%)	11.5-14
Beta (%)	3.0-5.0
Cohumulone (% of Alpha Acids)	22-30
Total Oil (ml/100g)	0.9-1.3
Myrcene (% of Total Oil)	27-42
Humulene (% of Total Oil)	16-19
Caryophyllene (% of Total Oil)	7-10
Farnesene (% of Total Oil)	< 1
Linalool (% of Total Oil)	0.5-1.0
Total Polyphenols (%)	—



OPAL

Opal is a German hop developed at the Hüll Research Center as a daughter of Hallertau Gold.

The hop exhibits excellent aroma characteristics combined with a moderate alpha acid concentration.



SPICY



WOODY
AROMATIC



CITRUS



SWEET
FRUIT

Aniseed, fresh pepper, cognac, bergamot, apricot.

Alpha (%)	5.0-8.0
Beta (%)	3.5-5.5
Cohumulone (% of Alpha Acids)	13-17
Total Oil (ml/100g)	0.8-1.3
Myrcene (% of Total Oil)	20-45
Humulene (% of Total Oil)	30-50
Caryophyllene (% of Total Oil)	8-15
Farnesene (% of Total Oil)	< 1
Linalool (% of Total Oil)	1.0-1.5
Total Polyphenols (%)	3-5



PACIFICA™

Pacifica™ was bred by the New Zealand Plant & Food Hop Research Centre and released in 1994.

It is a triploid variety that arose from the open pollination of Hallertauer Mittelfrüh. In beer, Pacifica displays Old World noble flavors as well as New World citrus and fruit attributes.



CITRUS

SWEET
FRUIT

FLORAL



SPICY

Orange marmalade, noble spice.

Alpha (%)	5.0-6.0
Beta (%)	6.0
Cohumulone (% of Alpha Acids)	25
Total Oil (ml/100g)	1
Myrcene (% of Total Oil)	12.5
Humulene (% of Total Oil)	50.9
Caryophyllene (% of Total Oil)	16.7
Farnesene (% of Total Oil)	0.2
Linalool (% of Total Oil)	—
Total Polyphenols (%)	—



PAHTO®

HBC 682 c.v.

Pahto® HBC 682 c.v. is a super-alpha hop cultivar with a very mild and pleasant aroma, high yield with a very high alpha content, good storage stability and resistance to hop powdery and downy mildew. Pahto was developed by the Hop Breeding Company (HBC) for hot side additions to efficiently deliver bitterness to beer. When used as a bittering hop, Pahto provides a very neutral flavor to beer, and a pleasant bitterness. The aroma profile of the hop cone is described as herbal, earthy, woody, and resinous with some fruit.



SWEET
FRUIT



HERBAL



FLORAL



WOODY
AROMATIC

Melon, thyme, lily of the valley, resin, potting soil.

Alpha (%)	17.0-20.0
Beta (%)	4.5-6.0
Cohumulone (% of Alpha Acids)	—
Total Oil (ml/100g)	1.0-2.5
Myrcene (% of Total Oil)	48-52
Humulene (% of Total Oil)	13-15
Caryophyllene (% of Total Oil)	4-6
Farnesene (% of Total Oil)	—
Linalool (% of Total Oil)	0-1
Total Polyphenols (%)	—



PALISADE®

Palisade® is an aroma variety bred in the U.S. by Yakima Chief Ranches (YCR). It is popular in brewing for its aromatic properties and moderate bittering and has good resistance to powdery mildew. Palisade appears to be named after a hop field enclosure used in cultivation to facilitate the climbing hop. The cultivar is a result of open pollination.



SWEET
FRUIT



FLORAL



GREEN-
GRASSY

Apricot, clean floral, fresh-cut grass.

Alpha (%)	6.5-9.5
Beta (%)	6-8
Cohumulone (% of Alpha Acids)	26-30
Total Oil (ml/100g)	0.8-2
Myrcene (% of Total Oil)	45-55
Humulene (% of Total Oil)	10-20
Caryophyllene (% of Total Oil)	8-14
Farnesene (% of Total Oil)	0.1-1
Linalool (% of Total Oil)	0.2-0.6
Total Polyphenols (%)	—



PEKKO®

ADHA 871 c.v.

UNITED STATES

Named after the Finnish god of field and crops, Pekko® ADHA 871 c.v. is a recent release from the Association for the Development of Hop Agronomy (ADHA) breeding program in the Yakima Valley. Pekko's mother is ADHA 538 c.v., bred with open pollination.



CITRUS



MENTHOL



SWEET
FRUIT



FLORAL

**Lemongrass, eucalyptus, sage, pineapple,
banana, lilac, chamomile.**

Alpha (%)	13-16
Beta (%)	3.5-4.3
Cohumulone (% of Alpha Acids)	27-30
Total Oil (ml/100g)	2.1-2.7
Myrcene (% of Total Oil)	46-55
Humulene (% of Total Oil)	12-15
Caryophyllene (% of Total Oil)	11-13
Farnesene (% of Total Oil)	< 1
Linalool (% of Total Oil)	—
Total Polyphenols (%)	—



PERLE

The combination of good alpha acids content with desirable aroma gave rise to Perle's popularity. High yields and good tolerance to most diseases make this variety attractive also for growers. Bred from the variety Northern Brewer, Perle was released in 1978 and is well established in Germany. Perle has also been grown in the U.S. in both Washington and Oregon.



HERBAL



MENTHOL



CITRUS

GREEN
FRUIT

Marjoram, peppermint, lime, pear.

Alpha (%)	4-9
Beta (%)	2.5-4.5
Cohumulone (% of Alpha Acids)	29-35
Total Oil (ml/100g)	0.5-1.5
Myrcene (% of Total Oil)	20-35
Humulene (% of Total Oil)	35-55
Caryophyllene (% of Total Oil)	10-20
Farnesene (% of Total Oil)	<1
Linalool (% of Total Oil)	0.2-0.6
Total Polyphenols (%)	3-5



PILGRIM

Pilgrim was developed by Wye Hops Ltd., and gained European Plant Variety Rights in 2006. It has very good resistance to wilt disease and is being planted in areas where this disease is present, often replacing Wye Target. Pilgrim was bred from Yeoman in the late 1990s.



MENTHOL



HERBAL



CITRUS

Peppermint, marjoram, lime.

Alpha (%)	9-13
Beta (%)	4-5
Cohumulone (% of Alpha Acids)	35
Total Oil (ml/100g)	1-1.8
Myrcene (% of Total Oil)	30-35
Humulene (% of Total Oil)	21-25
Caryophyllene (% of Total Oil)	—
Farnesene (% of Total Oil)	0.3
Linalool (% of Total Oil)	—
Total Polyphenols (%)	—



POLARIS

Polaris is a German variety which has an intense aroma and a refreshing note, described by some as mint drop.

The variety was bred at the Hüll Research Center from a Hüll breeding line and released in 2012.



MENTHOL

SWEET
FRUIT

CITRUS

WOODY
AROMATIC

Mint, pineapple, bergamot, woodruff.

Alpha (%)	18-24
Beta (%)	5-6.5
Cohumulone (% of Alpha Acids)	22-28
Total Oil (ml/100g)	2.4-4.4
Myrcene (% of Total Oil)	up to 50.3
Humulene (% of Total Oil)	20-35
Caryophyllene (% of Total Oil)	8-13
Farnesene (% of Total Oil)	< 1
Linalool (% of Total Oil)	up to 0.2
Total Polyphenols (%)	2.6-2.7



PREMIANT

Premiant is a Czech dual-purpose hop variety selected from hybrid progenies of the Saaz variety and other breeding material. It was registered in 1996 and has good agronomic yield. Premiant is defined as ‘prizewinning’ in Czech.



SWEET
FRUIT



CITRUS



FLORAL



CREAM
CARAMEL

Passion fruit, lemongrass, jasmine, lavender, chocolate.

Alpha (%)	7.0-10.0
Beta (%)	3.5-5.5
Cohumulone (% of Alpha Acids)	18-23
Total Oil (ml/100g)	1.0-2.0
Myrcene (% of Total Oil)	35-45
Humulene (% of Total Oil)	25-40
Caryophyllene (% of Total Oil)	9-13
Farnesene (% of Total Oil)	1-3
Linalool (% of Total Oil)	0.4-0.7
Total Polyphenols (%)	4.0-5.0



PRIDE OF RINGWOOD

Pride of Ringwood was bred by Carlton and United Breweries in 1953 at their Ringwood Research Station in Melbourne, Victoria. This cultivar was bred by open pollination of a female related to the English cultivar Pride of Kent, grown commercially since the 1960s.



CITRUS

WOODY
AROMATIC

HERBAL

Ginger, cedar, pine resin, earth, tarragon, mate tea.

Alpha (%)	8.6-11.0
Beta (%)	4.0-8.0
Cohumulone (% of Alpha Acids)	25-34
Total Oil (ml/100g)	1.0-2.0
Myrcene (% of Total Oil)	30-41
Humulene (% of Total Oil)	1.6-3.0
Caryophyllene (% of Total Oil)	10-12
Farnesene (% of Total Oil)	< 1
Linalool (% of Total Oil)	—
Total Polyphenols (%)	—



PROGRESS

Progress is a daughter of Whitbread Golding and OB79 c.v. The variety was developed at Wye College and released for commercial growing in 1964. It was bred as a Fuggle replacement. Its aroma profile and alpha content is ideally suited to British style beers.



BERRY &
CURRANT



CREAM
CARAMEL



SPICY

Cassis, cream, honey, coriander.

Alpha (%)	6-7.5
Beta (%)	2-3.3
Cohumulone (% of Alpha Acids)	33
Total Oil (ml/100g)	0.8-1.0
Myrcene (% of Total Oil)	29
Humulene (% of Total Oil)	36-42
Caryophyllene (% of Total Oil)	—
Farnesene (% of Total Oil)	<1
Linalool (% of Total Oil)	—
Total Polyphenols (%)	—



RAKAU™

Rakau™ is a triploid variety that was developed by the New Zealand Plant & Food Hop Research Centre. When first released in 1983 the cultivar was known as AlphAroma. It was re-released in 2007 as Rakau. The hop is described as having unique fruit flavors with strong stone fruit character.



SWEET
FRUIT



CITRUS



GREEN
FRUIT

Apricot, fig, pineapple, orange, white wine grapes.

Alpha (%)	10.0-11.0
Beta (%)	5.0-6.0
Cohumulone (% of Alpha Acids)	24
Total Oil (ml/100g)	2.15
Myrcene (% of Total Oil)	56
Humulene (% of Total Oil)	16.3
Caryophyllene (% of Total Oil)	5.2
Farnesene (% of Total Oil)	4.5
Linalool (% of Total Oil)	—
Total Polyphenols (%)	—



RELAX

Originally bred as a hop for tea, Relax has a remarkably low alpha content but with high beta. Relax was developed from a breeding line from the Hüll Research Center in Germany.



WOODY
AROMATIC



SWEET
FRUIT



FLORAL



CITRUS

**Cognac, leather, melon, lychee, rose hip,
lavender, lemongrass.**

Alpha (%)	0.3-1.5
Beta (%)	10-15
Cohumulone (% of Alpha Acids)	—
Total Oil (ml/100g)	1-1.3
Myrcene (% of Total Oil)	17-30
Humulene (% of Total Oil)	—
Caryophyllene (% of Total Oil)	—
Farnesene (% of Total Oil)	—
Linalool (% of Total Oil)	0.3-0.5
Total Polyphenols (%)	—



RIWAKA™

85.6-23

Riwaka™ was released by the New Zealand Plant & Food Hop Research Centre in 1997. It is a triploid variety with Saaz and New Zealand parentage. As is true for all New Zealand varieties, Riwaka is free of hop diseases such as powdery mildew.



SWEET
FRUIT



CITRUS

Passion fruit, grapefruit.

Alpha (%)	4.5-6.5
Beta (%)	4.0-5.0
Cohumulone (% of Alpha Acids)	32
Total Oil (ml/100g)	1.5
Myrcene (% of Total Oil)	68
Humulene (% of Total Oil)	9
Caryophyllene (% of Total Oil)	4
Farnesene (% of Total Oil)	1
Linalool (% of Total Oil)	—
Total Polyphenols (%)	—



SAAZ

Saaz is the famous aroma landrace variety originating in the Czech area of the same name. It is considered by many as the world standard for a fine noble aroma hop. Since 1952, Saaz has been cultivated into nine separate clones, the last being in 1993.



CITRUS

CREAM
CARAMELWOODY
AROMATIC

FLORAL



SPICY

Bergamot, honey, woody, chamomile tea, spicy.

Alpha (%)	2.5-4.5
Beta (%)	4.0-6.0
Cohumulone (% of Alpha Acids)	23-26
Total Oil (ml/100g)	0.4-0.8
Myrcene (% of Total Oil)	25-40
Humulene (% of Total Oil)	15-30
Caryophyllene (% of Total Oil)	6-9
Farnesene (% of Total Oil)	14-20
Linalool (% of Total Oil)	0.4-0.6
Total Polyphenols (%)	5.5-7.0



SAAZ LATE

Saaz Late is a Czech selection bred from parents with origins in the Saaz region. The variety was released in 2010 from the Hop Research Institute Co., Ltd., in Czechia.



SWEET
FRUIT



CITRUS



BERRY &
CURRANT



FLORAL

Passion fruit, lemon, raspberry, blackberry, chamomile tea.

Alpha (%)	3.5-6.0
Beta (%)	4.0-6.5
Cohumulone (% of Alpha Acids)	20-25
Total Oil (ml/100g)	0.5-1.0
Myrcene (% of Total Oil)	25-35
Humulene (% of Total Oil)	15-25
Caryophyllene (% of Total Oil)	6-9
Farnesene (% of Total Oil)	15-20
Linalool (% of Total Oil)	0.2-0.4
Total Polyphenols (%)	5.0-6.0



SABRO®

HBC 438 c.v.

UNITED STATES

Sabro® HBC 438 c.v. was developed by the Hop Breeding Company (HBC) and released in 2018. Her pedigree is the result of a unique cross pollination of YCR 123 c.v., a female *neomexicanus* hop. Sabro imparts a strong and complex fruit flavor to beer. Its flavor is notable for its complexity of fruity and citrus attributes, including distinct tangerine, coconut, tropical and stone fruit. In addition, there is a pronounced cream character and secondary flavors of vanilla, cedar, dill, and mint.



CITRUS



SWEET
FRUIT



CREAM
CARAMEL

Tangerine, tropical fruit, stone fruit, coconut.

Alpha (%)	12.0-16.0
Beta (%)	4.0-7.0
Cohumulone (% of Alpha Acids)	—
Total Oil (ml/100g)	2.5-3.5
Myrcene (% of Total Oil)	40-55
Humulene (% of Total Oil)	10-15
Caryophyllene (% of Total Oil)	15-20
Farnesene (% of Total Oil)	< 1
Linalool (% of Total Oil)	0-1
Total Polyphenols (%)	—



SANTIAM

Santiam is an American hop that contains noble hop characteristics similar to German grown Tett nang Tett nanger. Released in 1997, this hop is tolerant to downy mildew but susceptible to powdery mildew.



FLORAL



HERBAL



SPICY

Floral, herbal, black pepper.

Alpha (%)	5.5-7.0
Beta (%)	7.0-8.5
Cohumulone (% of Alpha Acids)	20-22
Total Oil (ml/100g)	1.3-1.7
Myrcene (% of Total Oil)	30-45
Humulene (% of Total Oil)	20-25
Caryophyllene (% of Total Oil)	5-8
Farnesene (% of Total Oil)	13-16
Linalool (% of Total Oil)	—
Total Polyphenols (%)	—



SAPHIR

Saphir was developed as an aroma variety at the Hop Research Center in Hüll, Germany and released in 2002. At that time, Saphir differed considerably from other German aroma varieties due its fruity character.



SPICY



CITRUS



BERRY &
CURRANT



HERBAL

Juniper, lemongrass, bergamot, strawberry, black tea.

Alpha (%)	2-4.5
Beta (%)	4-7
Cohumulone (% of Alpha Acids)	12-17
Total Oil (ml/100g)	0.8-1.4
Myrcene (% of Total Oil)	25-40
Humulene (% of Total Oil)	20-30
Caryophyllene (% of Total Oil)	9-14
Farnesene (% of Total Oil)	< 1
Linalool (% of Total Oil)	0.8-1.3
Total Polyphenols (%)	4-5



SASQUATCH

Sasquatch was discovered as a wild hop by Hops Connect in Pemberton, British Columbia. It is Canada's first proprietary, patented hop.

The Sasquatch name is evocative of the mountainous terrain it was found in as well as the large cones the plant produces. The cultivar is grown in Leamington, Ontario and Chilliwack, BC.



FLORAL



CITRUS

CREAM
CARAMELGREEN-
GRASSY

Apple blossom, orange, cream, hay.

Alpha (%)	7.3
Beta (%)	8.2
Cohumulone (% of Alpha Acids)	34.6
Total Oil (ml/100g)	0.8
Myrcene (% of Total Oil)	60.1
Humulene (% of Total Oil)	13.7
Caryophyllene (% of Total Oil)	5.9
Farnesene (% of Total Oil)	8.3
Linalool (% of Total Oil)	0.1
Total Polyphenols (%)	—



SIMCOE®

Simcoe® is a hop bred by Yakima Chief Ranches (YCR) and is known for its unique flavor properties. It was released and trademarked in 2000.



CITRUS

SWEET
FRUITWOODY
AROMATIC

**Grapefruit, stone fruit, passion fruit,
bubblegum, earth, pine.**

Alpha (%)	12.0-15.5
Beta (%)	3.5-5.5
Cohumulone (% of Alpha Acids)	17-21
Total Oil (ml/100g)	1.5-3.0
Myrcene (% of Total Oil)	45-55
Humulene (% of Total Oil)	12-20
Caryophyllene (% of Total Oil)	6-12
Farnesene (% of Total Oil)	0.1-1
Linalool (% of Total Oil)	0.4-0.8
Total Polyphenols (%)	—



SLÁDEK

Registered in 1994, Sládek is a hybrid variety of Saaz-type with excellent impact on hoppy taste and aroma of beer. It is a late harvest cultivar with high yield. The hop was selected from hybrid progenies of Northern Brewer and Saaz. The name Sládek is Czech for “brewer.”



SWEET
FRUIT



BERRY &
CURRANT



CITRUS

Passion fruit, strawberry, cassis, grapefruit, peach.

Alpha (%)	4.5-8.0
Beta (%)	4.0-7.0
Cohumulone (% of Alpha Acids)	23-30
Total Oil (ml/100g)	1.0-2.0
Myrcene (% of Total Oil)	35-50
Humulene (% of Total Oil)	20-40
Caryophyllene (% of Total Oil)	9-14
Farnesene (% of Total Oil)	< 1.0
Linalool (% of Total Oil)	0.15-0.30
Total Polyphenols (%)	3.5-5.0



SMARAGD

In English, Smaragd translates to emerald. Smaragd is tough to pronounce but it's a fine German hop variety. It has good disease resistance characteristics but some susceptibility to powdery mildew. The cultivar was developed at the Hop Research Center at Hüll Germany and is a daughter of Hallertau Gold.



SPICY

WOODY
AROMATIC

HERBAL



FLORAL

Licorice, cognac, tarragon, chamomile.

Alpha (%)	4-6
Beta (%)	3.5-5.5
Cohumulone (% of Alpha Acids)	13-18
Total Oil (ml/100g)	0.4-0.8
Myrcene (% of Total Oil)	20-40
Humulene (% of Total Oil)	30-50
Caryophyllene (% of Total Oil)	9-14
Farnesene (% of Total Oil)	< 1
Linalool (% of Total Oil)	0.9-1.4
Total Polyphenols (%)	4-6



SOLERO™

Solero™ Experimental 243/42 c.v. is a late harvest variety developed by the Hopsteiner. It is a daughter of a Cascade female and a Hopsteiner male.

The aroma of Solero is fruit forward with tropical, passion fruit, and mango attributes.



SWEET
FRUIT

Tropical fruit, mango, passion fruit.

Alpha (%)	9.0-10.0
Beta (%)	5.0-6.0
Cohumulone (% of Alpha Acids)	35-45
Total Oil (ml/100g)	1.5-2.0
Myrcene (% of Total Oil)	—
Humulene (% of Total Oil)	—
Caryophyllene (% of Total Oil)	—
Farnesene (% of Total Oil)	—
Linalool (% of Total Oil)	0.2-0.5
Total Polyphenols (%)	—



SORACHI ACE

JAPAN

Sorachi Ace was developed in 1984 for Sapporo Breweries, Ltd., from a cross of Brewer's Gold, Saaz, and male Beikei No. 2. The name "Sorachi" is derived from a sub-prefecture of Hokkaido, Japan. This variety has good yields and resistance to mildew, wilt and botrytis. It has relatively high alpha and oil content. Sorachi Ace is currently grown in limited quantities in the U.S.



CITRUS



HERBAL



SWEET
FRUIT

Over-ripe orange, lemongrass, dill, lychee.

Alpha (%)	12-16
Beta (%)	6-8
Cohumulone (% of Alpha Acids)	20-25
Total Oil (ml/100g)	1-1.5
Myrcene (% of Total Oil)	40-45
Humulene (% of Total Oil)	—
Caryophyllene (% of Total Oil)	—
Farnesene (% of Total Oil)	—
Linalool (% of Total Oil)	0.5-0.8
Total Polyphenols (%)	—



SOUTHERN AROMA

Southern Aroma is a South African bred aroma hop designed to perform under the daylight hour constraints of the region. It originated from a diploid seedling of a cross between Saaz and Hallertauer Mittelfrüh. Southern Aroma is described as having classic noble hop character with a fruity backdrop.



FLORAL



CITRUS

BERRY &
CURRANTSWEET
FRUITWOODY
AROMATIC

Wildflowers, lemon zest, black currant, mango, pine resin.

Alpha (%)	3.6-6.1
Beta (%)	4-6
Cohumulone (% of Alpha Acids)	16-22.6
Total Oil (ml/100g)	0.6-0.8
Myrcene (% of Total Oil)	18.3-20
Humulene (% of Total Oil)	23-30
Caryophyllene (% of Total Oil)	10-13.9
Farnesene (% of Total Oil)	0.6-1.6
Linalool (% of Total Oil)	<1
Total Polyphenols (%)	—



SOUTHERN PASSION

Southern Passion is a South African bred hop derived from a diploid crossing of Saaz and Hallertau parentage. This is a versatile hop that offers a complex and unique set of flavors.



SWEET
FRUIT



BERRY &
CURRANT



CITRUS



FLORAL

**Passion fruit, guava, black currant,
tangerine, grapefruit, calendula.**

Alpha (%)	5-12
Beta (%)	4-6
Cohumulone (% of Alpha Acids)	16.6-20.2
Total Oil (ml/100g)	0.7-1.3
Myrcene (% of Total Oil)	20-35
Humulene (% of Total Oil)	17-35
Caryophyllene (% of Total Oil)	8-13
Farnesene (% of Total Oil)	1-3
Linalool (% of Total Oil)	< 1
Total Polyphenols (%)	—



SOUTHERN PROMISE

Southern Promise was released in South Africa in 1992. This variety is adapted to the short day-length in the southern tip of Africa. It is a cross of Southern Brewer and a Slovenian male variety.

Southern Promise is relatively high in alpha with good aromatic qualities.



WOODY
AROMATIC

Woody, earthy.

Alpha (%)	9.5-11.5
Beta (%)	3.6-5.4
Cohumulone (% of Alpha Acids)	20-22
Total Oil (ml/100g)	0.7-1.1
Myrcene (% of Total Oil)	20-23
Humulene (% of Total Oil)	22-28
Caryophyllene (% of Total Oil)	8-10
Farnesene (% of Total Oil)	< 1
Linalool (% of Total Oil)	—
Total Polyphenols (%)	—



SOUTHERN STAR

Southern Star was released in 2001 in South Africa. It is a variety adapted to the region's short day-length and is a cross between Outeniqua and a South African male OF2/93 c.v. Southern Star is high in alpha for a variety grown in this area and has a relatively high farnesene content.



CITRUS



SWEET
FRUIT



BERRY &
CURRANT



WOODY
AROMATIC

Tangerine, pineapple, watermelon, blueberries, pine resin.

Alpha (%)	12-18
Beta (%)	4-6
Cohumulone (% of Alpha Acids)	25-30
Total Oil (ml/100g)	1.4-1.7
Myrcene (% of Total Oil)	27.5-38.9
Humulene (% of Total Oil)	21.9-32.8
Caryophyllene (% of Total Oil)	11.2-14.6
Farnesene (% of Total Oil)	4.5-12
Linalool (% of Total Oil)	< 1
Total Polyphenols (%)	—



SOVEREIGN

Sovereign is a hedgerow variety bred at Wye College in 1995 from an open pollination of a seedling of Pioneer. It was selected for its good aroma, often likened to that of Fuggle.



SWEET
FRUIT



GREEN
FRUIT



SPICY

Cherry, quince, gingerbread, fresh-cut hot peppers.

Alpha (%)	4.5-6.5
Beta (%)	2.1-3.1
Cohumulone (% of Alpha Acids)	26-30
Total Oil (ml/100g)	0.6-1.0
Myrcene (% of Total Oil)	25-30
Humulene (% of Total Oil)	21-26
Caryophyllene (% of Total Oil)	—
Farnesene (% of Total Oil)	3-5
Linalool (% of Total Oil)	—
Total Polyphenols (%)	—



SPALT SPALTER

Spalt Spalter is a German landrace variety with a fine aroma comparable to Tett nang Tett nanger. This hop belongs to the Saaz range and is cultivated exclusively in the region around Spalt. It has good resistance to wilt and other diseases.



SPICY

WOODY
AROMATICSWEET
FRUITCREAM
CARAMEL

HERBAL

**Black pepper, oak barrel, woodruff,
ripe banana, tonka bean, black tea.**

Alpha (%)	2.5-5.5
Beta (%)	3-5
Cohumulone (% of Alpha Acids)	22-29
Total Oil (ml/100g)	0.5-0.9
Myrcene (% of Total Oil)	20-35
Humulene (% of Total Oil)	20-30
Caryophyllene (% of Total Oil)	8-13
Farnesene (% of Total Oil)	12-18
Linalool (% of Total Oil)	0.5-0.8
Total Polyphenols (%)	5-6



SPALTER SELECT

Spalter Select was developed from Hüll Hop Research Center breeding stock. Its fine aroma and high farnesene content are typical of Spalt-type hops. This variety grows quickly and develops a very strong “head.” Spalter Select is characterized by a good tolerance to diseases like wilt and downy mildew.



CITRUS

WOODY
AROMATIC

HERBAL



FLORAL

Citrus, woody, black tea, chamomile blossoms.

Alpha (%)	3-6.5
Beta (%)	2.5-5
Cohumulone (% of Alpha Acids)	21-27
Total Oil (ml/100g)	0.6-0.9
Myrcene (% of Total Oil)	20-40
Humulene (% of Total Oil)	10-22
Caryophyllene (% of Total Oil)	4-10
Farnesene (% of Total Oil)	15-22
Linalool (% of Total Oil)	1-1.5
Total Polyphenols (%)	4-5



STERLING

Sterling is a cultivar with a complex pedigree that includes Saaz, Cascade, Brewers Gold, Early Green and an unknown variety. Released in 1998, Sterling is moderately resistant to downy and powdery mildews.



HERBAL



CITRUS



SPICY

Tarragon, orange blossom, lemon pepper.

Alpha (%)	6-9
Beta (%)	4-6
Cohumulone (% of Alpha Acids)	22-28
Total Oil (ml/100g)	1.3-1.9
Myrcene (% of Total Oil)	44-48
Humulene (% of Total Oil)	19-23
Caryophyllene (% of Total Oil)	5-7
Farnesene (% of Total Oil)	11-17
Linalool (% of Total Oil)	—
Total Polyphenols (%)	—



STRATA™

Strata™, formerly known as X-331 c.v., was the first variety released from the Indie Hops breeding program in 2009. This hop is the result of an open pollination of a Perle mother in an Oregon experimental hop yard. Strata has strong disease resistance and vigorous growth.



SWEET
FRUIT



BERRY &
CURRANT



MENTHOL

Melon, bubblegum, strawberries, fresh-rubbed sage.

Alpha (%)	12.1
Beta (%)	5.3
Cohumulone (% of Alpha Acids)	21
Total Oil (ml/100g)	2.3-3.5
Myrcene (% of Total Oil)	52-65
Humulene (% of Total Oil)	22-30
Caryophyllene (% of Total Oil)	5-12.5
Farnesene (% of Total Oil)	—
Linalool (% of Total Oil)	—
Total Polyphenols (%)	—



STRISSELSPALT

Strisselspalt is a major aroma hop of the Alsace area of France near Strasbourg. It is a fine example of a noble-aroma type hop from Europe. Strisselspalt has low cohumulone and typically a very low alpha content.



HERBAL



FLORAL



SPICY



CITRUS

Thyme, carnation, generic spicy, lemongrass.

Alpha (%)	1.8-2.5
Beta (%)	4-4.7
Cohumulone (% of Alpha Acids)	20-23
Total Oil (ml/100g)	0.6-0.8
Myrcene (% of Total Oil)	35-52
Humulene (% of Total Oil)	12.5-21
Caryophyllene (% of Total Oil)	6.1-10.2
Farnesene (mg/100g)	1.0
Linalool (mg/100g)	7
Total Polyphenols (%)	—



STYRIAN CARDINAL

Styrian Cardinal was bred at the Slovenian Institute of Hop Research and Brewing in Žalec. It was derived from unspecified European and American germplasm. This variety has a high alpha-acids content with complex fruity, floral, and herbal aroma notes.



HERBAL



CITRUS



FLORAL

SWEET
FRUIT

Marjoram, orange, geranium, pineapple.

Alpha (%)	10.0-15.0
Beta (%)	3.2-4.6
Cohumulone (% of Alpha Acids)	31-37
Total Oil (ml/100g)	3.0-4.0
Myrcene (% of Total Oil)	40-50
Humulene (% of Total Oil)	15-22
Caryophyllene (% of Total Oil)	8-11
Farnesene (% of Total Oil)	5-7
Linalool (% of Total Oil)	0.6-1.0
Total Polyphenols (%)	5.3-6.3



STYRIAN EAGLE

Styrian Eagle was developed at the Slovenian Institute of Hop Research and Brewing in Žalec. It was bred from unspecified European and American germplasms.



MENTHOL

SWEET
FRUITBERRY &
CURRANTGREEN-
GRASSY

CITRUS

Menthol, banana, peach, red berries, hay, lemon.

Alpha (%)	12.5-17.5
Beta (%)	3.5-5.5
Cohumulone (% of Alpha Acids)	20-23
Total Oil (ml/100g)	2.5-3.9
Myrcene (% of Total Oil)	52-60
Humulene (% of Total Oil)	0.9-2.1
Caryophyllene (% of Total Oil)	4.2-7.0
Farnesene (% of Total Oil)	6.5-9.5
Linalool (% of Total Oil)	0.3-0.5
Total Polyphenols (%)	3.6-4.6



STYRIAN EUREKA

Styrian Eureka arose from the breeding program at the Slovenian Institute of Hop Research and Brewing in Žalec. Styrian Eureka was derived from unspecified traditional Slovenian and foreign hop germplasm.



GREEN
FRUIT



FLORAL



BERRY &
CURRANT



SWEET
FRUIT

Muscat, geranium, blueberry, strawberry, mango.

Alpha (%)	11.0-17.0
Beta (%)	3.5-5.0
Cohumulone (% of Alpha Acids)	21-25
Total Oil (ml/100g)	2.5-4.0
Myrcene (% of Total Oil)	50-60
Humulene (% of Total Oil)	17.0-23.0
Caryophyllene (% of Total Oil)	5.0-7.0
Farnesene (% of Total Oil)	0.1-0.4
Linalool (% of Total Oil)	0.7-0.9
Total Polyphenols (%)	3.5-4.5



STYRIAN GOLD

Styrian Gold was bred to improve the agronomic values of the traditional Savinjski Golding and released in 2009.

The hop is valued for its noble flavor characteristics.



HERBAL



GREEN-GRASSY



CREAM-CARAMEL

Oregano, basil, hay, nettle, honey.

Alpha (%)	3.5-6.5
Beta (%)	3.5-5.9
Cohumulone (% of Alpha Acids)	28-35
Total Oil (ml/100g)	1.3-2.3
Myrcene (% of Total Oil)	38-47
Humulene (% of Total Oil)	19-22
Caryophyllene (% of Total Oil)	5-10
Farnesene (% of Total Oil)	6-10
Linalool (% of Total Oil)	1.3-2.3
Total Polyphenols (%)	—



STYRIAN SAVINJSKI GOLDING

Styrian Savinjski Golding, also known as Savinjski Golding, is a traditional Slovenian variety. It originated from the English variety Fuggle, which was brought to Slovenia in the early 19th century. This variety is known for its noble hop aroma and pleasant bitterness.



HERBAL



GREEN-GRASSY



MENTHOL



CITRUS

Green tea, nettle, peppermint, lemon, lemongrass.

Alpha (%)	2.8-6.1
Beta (%)	1.8-4.1
Cohumulone (% of Alpha Acids)	27-33
Total Oil (ml/100g)	0.3-1.7
Myrcene (% of Total Oil)	25-38
Humulene (% of Total Oil)	29-38
Caryophyllene (% of Total Oil)	9-12
Farnesene (% of Total Oil)	6-8
Linalool (% of Total Oil)	0.1-0.2
Total Polyphenols (%)	—



STYRIAN WOLF

Styrian Wolf is another in the line of cultivars that have been developed by the Slovenian Institute of Hop Research and Brewing. Crosses of unspecified European and American germplasms were utilized in the breeding of this hop. It is reported to have a very intense aroma.



HERBAL



FLORAL



SPICY

SWEET
FRUIT

Thyme, geranium, chili pepper, anise, melon.

Alpha (%)	13.5-18.5
Beta (%)	5.0-6.0
Cohumulone (% of Alpha Acids)	22-23
Total Oil (ml/100g)	3.0-4.5
Myrcene (% of Total Oil)	60-70
Humulene (% of Total Oil)	5.0-9.0
Caryophyllene (% of Total Oil)	2.0-3.0
Farnesene (% of Total Oil)	4.5-6.5
Linalool (% of Total Oil)	0.8-1.3
Total Polyphenols (%)	4.7-5.7



SULTANA™

Sultana™ is a high-alpha hop with very high essential oil content. It was developed through the Hopsteiner hop breeding program in Yakima and was formerly known as Hopsteiner Experimental 06277 c.v. and Denali®. The pedigree is 50% Nugget, 25% Zeus and 25% USDA 19058m c.v.



SWEET
FRUIT



WOODY
AROMATIC



CITRUS

Pineapple, pine, citrus.

Alpha (%)	13-15
Beta (%)	4-5
Cohumulone (% of Alpha Acids)	22-26
Total Oil (ml/100g)	2.5-4
Myrcene (% of Total Oil)	—
Humulene (% of Total Oil)	—
Caryophyllene (% of Total Oil)	—
Farnesene (% of Total Oil)	—
Linalool (% of Total Oil)	0.6-1
Total Polyphenols (%)	2.5-3.0



SUMMIT®

Summit® is a dwarf high-alpha variety bred by the Association for the Development of Hop Agronomy (ADHA) in the U.S. Released in 2003, it has high alpha acid content, excellent storage stability and powdery mildew resistance.



VEGETAL



CITRUS



HERBAL

Wild garlic, grapefruit, tangerine, oregano.

Alpha (%)	16-19
Beta (%)	3-6
Cohumulone (% of Alpha Acids)	26-33
Total Oil (ml/100g)	1.5-2.5
Myrcene (% of Total Oil)	30-50
Humulene (% of Total Oil)	15-25
Caryophyllene (% of Total Oil)	10-15
Farnesene (% of Total Oil)	< 1
Linalool (% of Total Oil)	—
Total Polyphenols (%)	—



SUPER GALENA™

Super Galena™ is a high alpha variety developed by the Hopsteiner breeding program and released in 2006. It has relatively high content of both alpha and beta acids; a good bittering hop with pleasant aroma. It is a result of open pollination.



GREEN-GRASSY



SPICY

Grass, spicy.

Alpha (%)	13.0-16.0
Beta (%)	8.0-10.0
Cohumulone (% of Alpha Acids)	35-40
Total Oil (ml/100g)	0.8-2.5
Myrcene (% of Total Oil)	—
Humulene (% of Total Oil)	—
Caryophyllene (% of Total Oil)	—
Farnesene (% of Total Oil)	0-1
Linalool (% of Total Oil)	0.3-0.6
Total Polyphenols (%)	—



SUPER PRIDE

The Australian Super Pride is a seedless variety with moderately high levels of alpha acids. Super Pride was bred at Rostrevor Hop Gardens in Australia. The hop is a descendant of Pride of Ringwood.



SWEET
FRUIT



CITRUS



WOODY
AROMATIC

Dried fruit, bergamot, resin.

Alpha (%)	12.3-16.9
Beta (%)	5.2-10.7
Cohumulone (% of Alpha Acids)	24.0-30.0
Total Oil (ml/100g)	1.3-2.7
Myrcene (% of Total Oil)	17-44
Humulene (% of Total Oil)	1-2
Caryophyllene (% of Total Oil)	3.4-9.8
Farnesene (% of Total Oil)	0.0-0.1
Linalool (% of Total Oil)	0.2-0.7
Total Polyphenols (%)	—



SYBILLA

Sybilla is a Polish hop derived from a cross of Lubelski and Slovenian Styrian Golding. It was released by the Institute of Soil Science and Plant Cultivation (IUNG) Pulawy in 1996. Subsequently, in 2004-2006, hop latent viroid-free seedlings of Sybilla were produced. Its aroma is described as mild and distinctive.



CREAM
CARAMEL



WOODY
AROMATIC



CITRUS

Chocolate, barrel, tobacco, orange, lemon.

Alpha (%)	5-8
Beta (%)	3.0
Cohumulone (% of Alpha Acids)	28.6
Total Oil (ml/100g)	2
Myrcene (% of Total Oil)	50.9
Humulene (% of Total Oil)	17.4
Caryophyllene (% of Total Oil)	8.4
Farnesene (% of Total Oil)	—
Linalool (% of Total Oil)	—
Total Polyphenols (%)	—



TAHOMA

Tahoma is a United States Department of Agriculture (USDA) variety developed through Washington State University and released in 2013. A daughter of Glacier, Tahoma has moderate alpha and low cohumulone content.

Tahoma is the Native American name for Washington state's highest peak, Mt. Rainier.



CITRUS

WOODY
AROMATIC

Lemon, pine resin.

Alpha (%)	7.2-8.2
Beta (%)	8.5-9.5
Cohumulone (% of Alpha Acids)	15-17
Total Oil (ml/100g)	1.0-2.0
Myrcene (% of Total Oil)	67-72
Humulene (% of Total Oil)	9-11
Caryophyllene (% of Total Oil)	2.9-3.5
Farnesene (% of Total Oil)	0-1
Linalool (% of Total Oil)	—
Total Polyphenols (%)	—



TAIHEKE®

The cultivar leading to Taiheke® Brand was originally developed in the United States Department of Agriculture (USDA) breeding program in the 1950s (USDA 56013 c.v.). Taiheke was released commercially through USDA-Agricultural Research Service (ARS) in 1972. Its parentage is English Fuggle with a male selection believed to be a cross of Fuggle and the Russian variety Serebrianka.



CITRUS

SWEET
FRUIT

Grapefruit, lime, tropical fruit.

Alpha (%)	6-8
Beta (%)	5.0-5.5
Cohumulone (% of Alpha Acids)	37
Total Oil (ml/100g)	1.1
Myrcene (% of Total Oil)	53.6
Humulene (% of Total Oil)	14.5
Caryophyllene (% of Total Oil)	5.4
Farnesene (% of Total Oil)	6
Linalool (% of Total Oil)	—
Total Polyphenols (%)	—



TALUS®

HBC 692 c.v.

UNITED STATES

Talus® HBC 692 c.v. is a hop cultivar that was developed by the Hop Breeding Company (HBC). The hop delivers big aromas of pink grapefruit, citrus rinds, dried roses, pine resin, tropical fruits and sage. These unique and impactful aromas remain throughout the brewing process.



CITRUS



FLORAL



WOODY
AROMATIC

Pink grapefruit, dried roses, pine resin.

Alpha (%)	8.1-9.5
Beta (%)	8.3-10.2
Cohumulone (% of Alpha Acids)	34-39
Total Oil (ml/100g)	2.0-2.7
Myrcene (% of Total Oil)	40-50
Humulene (% of Total Oil)	16-21
Caryophyllene (% of Total Oil)	9-13
Farnesene (% of Total Oil)	0-1
Linalool (% of Total Oil)	0-1
Total Polyphenols (%)	—



TETTANG TETTANGER

The Tettang Tettanger variety, also known as Tettanger, is a traditional and indigenous hop from the Saaz group. It is mainly cultivated around Tettanger in the Lake Constance region of Germany. This location provides favorable climate and sandy clay soils that promotes the production of fine hop aroma. This variety has a good tolerance to plant diseases. Tettang Tettanger is widely used in lager beer styles.



FLORAL

WOODY
AROMATICCREAM
CARAMEL

CITRUS

Lily of the valley, cognac, chocolate, bergamot.

Alpha (%)	2.5-5.5
Beta (%)	3-5
Cohumulone (% of Alpha Acids)	22-28
Total Oil (ml/100g)	0.5-0.9
Myrcene (% of Total Oil)	20-35
Humulene (% of Total Oil)	22-32
Caryophyllene (% of Total Oil)	6-11
Farnesene (% of Total Oil)	16-24
Linalool (% of Total Oil)	0.4-0.9
Total Polyphenols (%)	5-6



TOMAHAWK®

Columbus, Tomahawk® and Zeus (CTZ) are super high alpha varieties. They share the same female parent as Nugget making them at least half sisters to Nugget. The CTZ varieties are currently used almost exclusively for beer bittering.



CITRUS



SPICY



VEGETAL

SWEET
FRUIT

Lemon, black pepper, green onion, mango.

Alpha (%)	15.0-17.0
Beta (%)	4.5-5.0
Cohumulone (% of Alpha Acids)	28-32
Total Oil (ml/100g)	2.5-3.5
Myrcene (% of Total Oil)	50-60
Humulene (% of Total Oil)	12-18
Caryophyllene (% of Total Oil)	9-11
Farnesene (% of Total Oil)	< 1
Linalool (% of Total Oil)	—
Total Polyphenols (%)	—



TOPAZ™

TC-85-70 c.v.

Topaz™ TC-85-70 c.v. was created by the Hop Products Australia (HPA) breeding program in 1985 and commercialized in 1997. Its ancestry is a cross pollination of high alpha Australian and Wye College hops, which provides an interesting mix of English, European and North American heritage.

BERRY &
CURRANTGREEN
FRUITSWEET
FRUITWOODY
AROMATIC

Blackberry, cassis, gooseberry, lychee, tobacco, pine resin.

Alpha (%)	16.2-20.1
Beta (%)	4.9-6.7
Cohumulone (% of Alpha Acids)	47.0-53.0
Total Oil (ml/100g)	1.3-1.8
Myrcene (% of Total Oil)	18.0-53.0
Humulene (% of Total Oil)	8.9-16.6
Caryophyllene (% of Total Oil)	6.7-12.5
Farnesene (% of Total Oil)	0.0-0.9
Linalool (% of Total Oil)	0.5-0.9
Total Polyphenols (%)	—



TRADITION

Tradition, also known as Hallertau Tradition, is a variety bred and released at Hüll Research Center in 1993. The hop is a cross between Hallertau Gold and a Hüll experimental variety. It is characterized by its fine aroma and moderate bitter content and can be compared to Hallertauer Mittelfrüh. Tradition stands out due to good yields which remain relatively stable even in difficult growing years.



SWEET
FRUIT



BERRY &
CURRANT



CITRUS

Apricot, peach, cassis, orange.

Alpha (%)	4.0-7.0
Beta (%)	3.0-6.0
Cohumulone (% of Alpha Acids)	24-30
Total Oil (ml/100g)	0.5-1.0
Myrcene (% of Total Oil)	17-32
Humulene (% of Total Oil)	35-50
Caryophyllene (% of Total Oil)	10-15
Farnesene (% of Total Oil)	< 1
Linalool (% of Total Oil)	0.7-1.2
Total Polyphenols (%)	4-5



TRIPLE PEARL

Released by the United States Department of Agriculture - Agricultural Research Service (USDA-ARS) breeding program in 2013.

Triple Pearl is a daughter of a triploid Perle mother and unknown diploid male. The lineage includes Northern Brewer and Hallertau.



CITRUS



SPICY

SWEET
FRUITWOODY
AROMATIC

Orange, pepper, melon, pine resin.

Alpha (%)	10.3-11.2
Beta (%)	3.3-4.2
Cohumulone (% of Alpha Acids)	39-55
Total Oil (ml/100g)	1.1-1.8
Myrcene (% of Total Oil)	39-55
Humulene (% of Total Oil)	7-11
Caryophyllene (% of Total Oil)	3-5
Farnesene (% of Total Oil)	—
Linalool (% of Total Oil)	—
Total Polyphenols (%)	—



TRISKEL

Triskel is a French hop cultivar developed in 2006 from a cross between Strisselspalt and English Yoeman. The name “Triskel” was inspired by triskelion, the symbol of the Gauls, ancestors of the modern French people.



FLORAL

SWEET
FRUITCREAM
CARAMEL

Wild flowers, stone fruits, caramel.

Alpha (%)	3-5
Beta (%)	4-5.5
Cohumulone (% of Alpha Acids)	20-23
Total Oil (ml/100g)	1.2-2
Myrcene (% of Total Oil)	55-60
Humulene (% of Total Oil)	13-16
Caryophyllene (% of Total Oil)	—
Farnesene (mg/100g)	0-1
Linalool (mg/100g)	10-15
Total Polyphenols (%)	—



TRIUMPH

Triumph is a public variety released by the United States Department of Agriculture (USDA) in collaboration with Pacific Northwest growers in 2019.

The hop was first grown at the Corvallis, Oregon USDA hop research facility and was named after an English motorcycle brand. It is descended from crosses utilizing Nugget, Brewers Gold, East Kent Golding, and Hallertauer Mittelfrüh.



SWEET
FRUIT



CITRUS



WOODY
AROMATIC

Peach, bubblegum, lime, orange, pine.

Alpha (%)	10.6-11.4
Beta (%)	3.34-3.95
Cohumulone (% of Alpha Acids)	22-26
Total Oil (ml/100g)	1.07-1.15
Myrcene (% of Total Oil)	25-40
Humulene (% of Total Oil)	28.0-33.6
Caryophyllene (% of Total Oil)	8.6-9.5
Farnesene (% of Total Oil)	—
Linalool (% of Total Oil)	> 1
Total Polyphenols (%)	—



ULTRA

Ultra was bred through the United States Department of Agriculture (USDA) Oregon State University hops research program in 1983. It is a triploid variety derived from a tetraploid Hallertauer Mittelfrüh and a Saaz-type male diploid genotype. It is half-sister to Mt. Hood, Liberty and Crystal. Released in 1995, Ultra has lower alpha than many U.S. aroma varieties.



FLORAL



SPICY

Dried flowers, mild spice.

Alpha (%)	3-5
Beta (%)	4-5
Cohumulone (% of Alpha Acids)	25-30
Total Oil (ml/100g)	1.3-1.5
Myrcene (% of Total Oil)	30
Humulene (% of Total Oil)	30-40
Caryophyllene (% of Total Oil)	12-14
Farnesene (% of Total Oil)	—
Linalool (% of Total Oil)	—
Total Polyphenols (%)	—



VIC SECRET™

00-207-013 c.v.

Vic Secret™ 00-207-013 c.v. was created by the Hop Products Australia breeding program in 2000 and commercialized in 2013. English, European, and North American hops figure prominently in Vic Secret's heritage. The variety was developed through breeding with high alpha Australian and Wye College hops.



SWEET
FRUIT



WOODY
AROMATIC



CITRUS

Passion fruit, pineapple, pine, ginger.

Alpha (%)	15.1-21.8
Beta (%)	6.4-8.1
Cohumulone (% of Alpha Acids)	51.0-56.0
Total Oil (ml/100g)	2.1-2.8
Myrcene (% of Total Oil)	31.0-46.0
Humulene (% of Total Oil)	9.4-12.2
Caryophyllene (% of Total Oil)	9.8-10.7
Farnesene (% of Total Oil)	0.0
Linalool (% of Total Oil)	0.7
Total Polyphenols (%)	—



WAI-ITI™

Wai-Iti™ is a triploid hop developed through the New Zealand Plant and Food Research Centre and released in 2011. It is a granddaughter of USDA Liberty and a Hallertauer Mittelfrüh triploid. Wai-Iti exhibits low alpha, moderate essential oils and low cohumulone.



SWEET
FRUIT



CITRUS

Fresh peaches, ripe apricot, lime.

Alpha (%)	2.5-3.5
Beta (%)	4.5-5.5
Cohumulone (% of Alpha Acids)	22-24
Total Oil (ml/100g)	1.6
Myrcene (% of Total Oil)	30
Humulene (% of Total Oil)	28
Caryophyllene (% of Total Oil)	9
Farnesene (% of Total Oil)	13
Linalool (% of Total Oil)	—
Total Polyphenols (%)	—



WAKATU™

Wakatu™, formerly known as New Zealand Hallertau, was renamed in 2011. The variety was originally released in 1988 from the New Zealand Hop Research program. It is a triploid derived from Hallertauer Mittelfrüh and open pollination. Wakatu is a classic style hop with a near 1:1 alpha-beta ratio.



FLORAL



CITRUS

Mild floral, lime zest.

Alpha (%)	6.5-8.5
Beta (%)	8.5
Cohumulone (% of Alpha Acids)	28-30
Total Oil (ml/100g)	1
Myrcene (% of Total Oil)	35.5
Humulene (% of Total Oil)	16.8
Caryophyllene (% of Total Oil)	8.2
Farnesene (% of Total Oil)	6.7
Linalool (% of Total Oil)	—
Total Polyphenols (%)	—



WARRIOR®

Warrior® is a high alpha variety developed by Yakima Chief Ranches (YCR). It has high agronomic yields and exhibits a moderate tolerance to powdery mildew. Warrior is characterized by a low cohumulone content and very good storage stability.



CITRUS



FLORAL



HERBAL

Tangerine, honeysuckle, sweet basil.

Alpha (%)	15.5-18
Beta (%)	4-5.5
Cohumulone (% of Alpha Acids)	25-28
Total Oil (ml/100g)	1-2.5
Myrcene (% of Total Oil)	40-50
Humulene (% of Total Oil)	12-18
Caryophyllene (% of Total Oil)	8-12
Farnesene (% of Total Oil)	0.1-1
Linalool (% of Total Oil)	0.2-0.5
Total Polyphenols (%)	—



WHITBREAD GOLDING VARIETY

Bred in 1911 on land owned by Whitbread. Not a true Golding, but similarly aromatic. Bred from Bates Brewer, Whitbread Golding Variety was selected as a seedling and planted extensively during the 1950s, when Verticillium Wilt started to encroach on the Fuggle and Golding.



SPICY



SWEET
FRUIT

Licorice, fig, banana, apricot.

Alpha (%)	5-7.5
Beta (%)	2.5-3.5
Cohumulone (% of Alpha Acids)	37
Total Oil (ml/100g)	0.8-1.2
Myrcene (% of Total Oil)	24-27
Humulene (% of Total Oil)	38-42
Caryophyllene (% of Total Oil)	—
Farnesene (% of Total Oil)	1-2
Linalool (% of Total Oil)	—
Total Polyphenols (%)	—



WILLAMETTE

Willamette, the triploid daughter of Fuggles, was released as a U.S. aroma variety in 1976 from the United State Department of Agriculture (USDA) breeding program in Oregon. The variety is characterized by a low alpha acids content, mild aroma similar to Fuggles, and average agronomic yields. Until the recent expansion of robust aroma varieties in the U.S., Willamette was a major American aroma variety.



WOODY
AROMATIC



SPICY



HERBAL

Cedar, incense, anise, marjoram.

Alpha (%)	4.0-6.0
Beta (%)	3.5-4.5
Cohumulone (% of Alpha Acids)	30-35
Total Oil (ml/100g)	1.0-1.5
Myrcene (% of Total Oil)	30-40
Humulene (% of Total Oil)	20-27
Caryophyllene (% of Total Oil)	7-8
Farnesene (% of Total Oil)	5-6
Linalool (% of Total Oil)	—
Total Polyphenols (%)	—



WYE CHALLENGER

Wye Challenger was developed at Wye College from a cross made in 1963 between Northern Brewer and Target. It was released for commercial growth in 1971. Wye Challenger combines good aroma with moderate bittering levels. Used to good effect for both bittering and late aromas in many classic British Bitters and Pale Ales.



SWEET
FRUIT



MENTHOL



CREAM
CARMEL



WOODY
AROMATIC

Banana, eucalyptus, vanilla, cognac.

Alpha (%)	6.5-9
Beta (%)	3.2-4.2
Cohumulone (% of Alpha Acids)	20-25
Total Oil (ml/100g)	1-1.5
Myrcene (% of Total Oil)	30
Humulene (% of Total Oil)	25
Caryophyllene (% of Total Oil)	—
Farnesene (% of Total Oil)	1
Linalool (% of Total Oil)	—
Total Polyphenols (%)	—



WYE TARGET

Wye Target was developed at Wye College and released in 1972. It was bred from Wye Challenger and has a subtle, pleasant aroma. A flexible hop that may be used to effectively bitter a wide variety of both Ales and Lagers.



WOODY
AROMATIC



CREAM
CARAMEL

Tobacco, cognac, caramel, vanilla.

Alpha (%)	8.5-13.5
Beta (%)	4-5.7
Cohumulone (% of Alpha Acids)	37
Total Oil (ml/100g)	1.2-1.8
Myrcene (% of Total Oil)	45
Humulene (% of Total Oil)	17
Caryophyllene (% of Total Oil)	—
Farnesene (% of Total Oil)	<1
Linalool (% of Total Oil)	—
Total Polyphenols (%)	—



YAKIMA GOLD

Yakima Gold was developed through the United States Department of Agriculture (USDA) hop breeding program at Washington State University and released in 2013. It is a cross of an Early Cluster and a wild Slovenian male hop with a moderate alpha content.



CITRUS



SPICY

Grapefruit, lemongrass, curry.

Alpha (%)	8.8-10.5
Beta (%)	4.3-5.0
Cohumulone (% of Alpha Acids)	21-23
Total Oil (ml/100g)	1.9-2.3
Myrcene (% of Total Oil)	45-50
Humulene (% of Total Oil)	21-25
Caryophyllene (% of Total Oil)	6-8
Farnesene (% of Total Oil)	9-10
Linalool (% of Total Oil)	—
Total Polyphenols (%)	—



ZAPPA™

Zappa™ was introduced by CLS Farms in Moxee, Washington. It was derived from a wild *neomexicanus* hop in New Mexico.



SWEET
FRUIT



MENTHOL



SPICY

Passion fruit, Fruity Pebbles™, tea tree, aniseed.

Alpha (%)	6-8
Beta (%)	8-9
Cohumulone (% of Alpha Acids)	—
Total Oil (ml/100g)	1.8-2.5
Myrcene (% of Total Oil)	64.4
Humulene (% of Total Oil)	4.6
Caryophyllene (% of Total Oil)	8.6
Farnesene (% of Total Oil)	—
Linalool (% of Total Oil)	0.8
Total Polyphenols (%)	—



ZEUS

Columbus, Tomahawk® and Zeus (CTZ) are super high alpha varieties. They share the same female parent as Nugget making them at least half sisters to Nugget. The CTZ varieties are currently used almost exclusively for beer bittering.



CITRUS



SPICY



VEGETAL

SWEET
FRUIT

Lemon, black pepper, green onion, mango.

Alpha (%)	15.0-17.0
Beta (%)	4.5-5.0
Cohumulone (% of Alpha Acids)	28-32
Total Oil (ml/100g)	2.5-3.5
Myrcene (% of Total Oil)	50-60
Humulene (% of Total Oil)	12-18
Caryophyllene (% of Total Oil)	9-11
Farnesene (% of Total Oil)	< 1
Linalool (% of Total Oil)	—
Total Polyphenols (%)	—



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