

ASBC Annual Meeting

June 4–7 ■ Fort Myers, Florida

See what SCIENCE can brew for you

The Language of Hops

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Technical Manager

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Hopessed – Barth-Haas Flavour Program

BARTH-HAAS GROUP
FOR YOUR SUCCESS

HOPSESSED

THE BARTH-HAAS GROUP UNIFORM TASTING SCHEME

WOODY AROMATIC
Tobacco, cognac, barktop, leather, woodruff, incense, myrrh, resin, cedar, pine, earth
e.g. in hop variety: RELAX

MENTHOL
Mint, balsam, camphor, menthol, rose yest
e.g. in hop variety: POLARIS

VEGETAL
Celery root, celery stalk, leek, onion, artichoke, garlic, wild garlic
e.g. in hop variety: SUMMIT*

FLORAL
Elderflower, camomile blossom, lily of the valley, jasmone, apple blossom, rose, geranium, carnation, lily, blue, lavender
e.g. in hop variety: ELLA™

RED BERRIES
Cassis, blueberry, raspberry, blackberry, strawberry and currant, black currant, wild strawberry, cranberry
e.g. in hop variety: MONROE

GREEN GRASSY
Green grass, tomato leaves, green pepper, fresh cut grass, hay, nettle, cucumber
e.g. in hop variety: HERKULES

CITRUS
Grapefruit, orange, lemons, lime, bergamot, lemon grass, ginger, tangerine
e.g. in hop variety: MANDARINA BAVARIA

SPICY
Pepper, chili, curry, juniper, cinnamon, Szechuan, fennel seeds, clove, cardamom, gingerbread, cardamom seeds, nutmeg
e.g. in hop variety: TAURUS

CREAM CARAMEL
Butter, chocolate, yogurt, honey, cream, caramel, toffee, coffee, tonka bean, vanilla
e.g. in hop variety: TRISKEL

GREEN FRUITS
Pear, apple, quince, gooseberry, white wine grape
e.g. in hop variety: HALLERTAU BLANC

SWEET FRUITS
Banana, watermelon, honeydew melon, peach, apricot, passion fruit, lychee, dried fruit, plum, pineapple, cherry, kiwi, mango, guava
e.g. in hop variety: MOSAIC*

HERBAL
Lavender, marjoram, tarragon, dill, parsley, basil, fennel, coriander, rosemary, thyme, green tea, black tea, white tea, sage
e.g. in hop variety: SAAZ

WHY DO WE NEED A UNIFORM TASTING SCHEME?

Hops are the soul of beer. In the last 10 years, hop usage in brewing has changed tremendously. Until then, a subtle to moderate hop aroma achieved with kettle additions was standard. Now with the importance of dry hopping and very high amounts of addition for hop aroma in the brewing process in general, the need for a sensory hop language is obvious. With the help of flavourists and sommeliers, we have developed a uniform tasting scheme specifically for hops and hoppy beers that works with 12 aroma categories and identifying specific aroma attributes. This tasting scheme's result is a defined and comparable aroma profile for the relevant hop variety or beer. This tasting scheme is meant to be a standard language in the brewing industry for hops so that an easier comparison of hop varieties and hoppy beers in a sensory context is possible.

BARTH-HAAS HOPS ACADEMY

HOPSESSED – BARTH-HAAS GROUP UNIFORM TASTING SCHEME

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WHAT DOES AROMA MEAN?

Aroma refers to all volatile components of a food or beverage which are in interaction with our olfactory system (especially *Bullus olfactorius*). The aroma and flavour perception is complemented by olfactory aroma release in the oral cavity. The processing of sensory data is highly complex. The stimuli forwarded to our brain influence various regions in the brain.*

AROMA CLASSIFICATION

Aroma components produce sensory impressions which are referred to as aroma. Not only the relevant stimuli but also these sensations can be classified. Both of these factors make it difficult because of the pure abundance of aromas, which is why attempts have so far been unsuccessful. One of the early formulations was compiled by Lorenz (1726). Following a classification according to the names of plants, all formulations have been working with 4 to 44 categories. In 1998, Harzer established a characterizing system for the food industry based on 44 different categories. Later on industry and institutions have selected about 160 descriptors that were used more frequently out of a pool of 800. The Harzer's Scale was published in 1985 in the Atlas of Odor Character Profiles and is today seen as the standard.**

SO WHAT IS REALLY THE CORRECT NUMBER OF CATEGORIES?

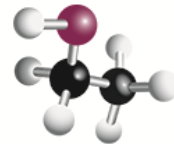
AROMA CATEGORIES AND EXAMPLES OF THE RELEVANT HOP VARIETIES

FLORAL ELLA*	CITRUS MANDARINA BAVARIA	SWEET FRUITS MOSAIC*	GREEN FRUITS HALLETTAU BLANC
RED BERRIES MONROE	CREAM CARAMEL TRISKEL	WOODY AROMATIC RELAX	MENTHOL POLARIS
HERBAL SAAZ	SPICY TAURUS	GREEN GRASSY HERKULES	VEGETAL SUMMIT*

BARTH-HAAS GROUP UNIFORM TASTING SCHEME

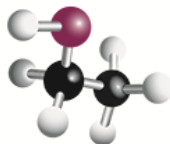
CATEGORY	SPECIFIC ATTRIBUTES	INTENSITY (1-10)	FOR BEER	RATING
FLORAL	Elderflower, camomile blossom, lily of the valley, jasmone, apple blossom, rose, geranium, carnation, lily, blue, lavender		AROMA INTENSITY (1-10)	
CITRUS	Grapefruit, orange, lemon, lime, bergamot, lemon grass, ginger, tangerine		AROMA QUALITY (1-10)	
SWEET FRUITS	Banana, watermelon, honeydew melon, peach, apricot, passion fruit, lychee, dried fruit, plum, pineapple, cherry, kiwi, mango, guava		BITTER INTENSITY (1-10)	
GREEN FRUITS	Pear, apple, quince, gooseberry, white wine grape		BITTER QUALITY (1-10)	
RED BERRIES	Cassis, blueberry, raspberry, blackberry, strawberry, red currant, black currant, wild strawberry, cranberry		HARMONY (1-10)	
CREAM CARAMEL	Butter, chocolate, yogurt, honey, cream, caramel, toffee, coffee, tonka bean, vanilla		BODY AND MOUTHFEEL (1-10)	
WOODY AROMATIC	Tobacco, cognac, barktop, leather, woodruff, incense, myrrh, resin, cedar, pine, earth		PREFERENCE	
MENTHOL	Mint, balsam, camphor, menthol, wine yeast		ESTIMATED BITTERNESS (IBU)	
HERBAL	Lavender, marjoram, tarragon, dill, parsley, basil, fennel, coriander, rosemary, thyme, green tea, black tea, white tea, sage			
SPICY	Pepper, chilli, curry, juniper, aniseed, liquorice, fennel seeds, clove, cardamom, gingerbread, cardamom seeds, nutmeg			
GREEN GRASSY	Green grass, tomato leaves, green pepper, fresh cut grass, hay, nettle, cucumber			
VEGETAL	Celery root, celery stalk, leek, onion, artichoke, garlic, wild garlic			

* Jahn, H. (2011). Food Science: Chemistry, sensory and technological principles, CRC Press. ** Harzer, G. (1992). Hopfen: Chemie, Anbau, Brauerei. For information about a professional training on this scheme and how to use it please contact our Technical Sales Support team at team_tss@barthhaas.de



WHY DO WE NEED A UNIFORM TASTING SCHEME?


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- In the last 10 years, hop usage has changed tremendously
- Now: High to massive additions for hop aroma in the brewing process
- With the help of flavourists and sommeliers, we have developed a uniform tasting scheme specifically for hops and hoppy beers
- 12 aroma categories, identifying specific aroma attributes
- It is meant to be a standard language in the brewing industry for hops
- For an easier comparison of hop varieties and hoppy beers in a sensory context



DLG Schema

Prüfbeleg —
Sensorische Prüfung

**Qualitätsprüfung
für Bier**



Schraffierte Felder vom Prüfer auszufüllen!

Ort: **Weihenstephan** Journal-Nr. Probe A: _____
 Datum: _____ Journal-Nr. Probe B: _____
 Prüfer: _____ Prüf-Nr. DLG : _____

Evtl. Geruchs- und Geschmacksfehler in der Spalte "Beschreibung" unterstreichen bzw. eintragen!

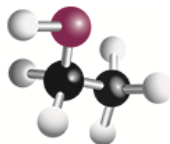
Prüfmerkmale	Erreichbare Punkte	Beschreibung	Erreichte Punkte	
			linke Probe () Nr. _____	rechte Probe () Nr. _____
Geruch	5	rein		
	4	noch rein		
	3	leichte Geruchsfehler		
	2	deutliche Geruchsfehler		
	1	starke Geruchsfehler		
Reinheit des Geschmacks	5	rein		
	4	noch rein		
	3	leichte Geschmacksfehler		
	2	deutliche Geschmacksfehler		
	1	starke Geschmacksfehler		
Vollmundigkeit	5	sortentypisch		
	4	typisch		
	3	noch typisch		
	2	wenig typisch		
	1	untypisch		
Rezenz	5	angenehm rezent		
	4	rezent		
	3	wenig rezent		
	2	schal		
	1	sehr schal		
Qualität der Bittere	5	sehr fein		
	4	fein		
	3	etwas nachhängend		
	2	nachhängend		
	1	stark nachhängend		

DLG – Deutsche Landwirtschafts-Gesellschaft (German Agricultural Association)

Evaluates beer (and also other food products)

Evaluated on a 1-5 point scale

- Aroma
- Purity of the taste
- Mouthfeel
- Carbonation
- Bitterness quality

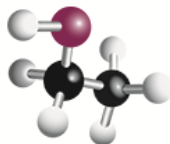


Modified Tasting Scheme St. Johann

(klare Biere) Probenbezeichnung			
Prüfkriterien			
Aussehen	Farbe	1 deutlich zu hell	9
		2 zu hell	8
		3 etwas zu hell	7
		4 Spur zu hell	6
		5 typgerecht	5
	4 Spur zu dunkel	4	
	3 etwas zu dunkel	3	
	2 zu dunkel	2	
	1 deutlich zu dunkel	1	
	Glanz / Trübung	5 klar, leuchtend	5
4 klar		4	
3 opalisierend		3	
2 opal		2	
1 trüb, Bodensatz		1	
Schaum	Poren-größe	5 durchgehend fein	5
		4 fein bis mittel	4
		3 mittel	3
		2 mittel bis grob	2
		1 grobe Blasen	1
	Haftvermögen	5 sehr gut anhaftend	5
4 gut anhaftend	4		
3 befriedigend anhaftend	3		
2 wenig anhaftend	2		
1 schlecht, kein Anhaften	1		
Geruch	5 typisch, ausgeprägter Charakter	5	
	4 rein, noch typisch	4	
	3 leichte Fehler	3	
	2 deutliche Geruchsfehler	2	
	1 starke Fehler, ungenießbar	1	
Ge-schmack	5 typisch, ausgeprägter Charakter	5	
	4 rein, noch typisch	4	
	3 leichte Fehler	3	
	2 deutliche Geschmacksfehler	2	
	1 starke Fehler, ungenießbar	1	

Trunk	Vollmundigkeit	1 deutlich zu voll, mastig	9
		2 zu voll	8
		3 etwas zu voll	7
		4 Spur zu voll	6
		5 typgerecht	5
Weichheit	Weichheit	4 Spur zu leer	4
		3 etwas zu leer	3
		2 leer	2
		1 deutlich zu leer, wässrig	1
		5 sehr weich	5
Rezenz	Rezenz	4 weich	4
		3 nicht ganz abgerundet	3
		2 unharmonisch	2
		1 hart	1
		1 adstringierend	9
		2 zu rezent	8
		3 etwas zu rezent	7
		4 Spur zu rezent	6
		5 angenehm rezent	5
		4 genügend rezent	4
3 mäßig rezent	3		
2 wenig rezent	2		
1 schal, abgestanden	1		
Bittere	Intensität	1 deutlich zu bitter	9
		2 zu bitter	8,5
		3 etwas zu bitter	8
		4 Spur zu bitter	7,5
		5 typgerecht bitter	7
		4 Spur zu wenig bitter	6,5
		3 etwas zu wenig bitter	6
		2 zu wenig bitter	5,5
		1 deutlich zu wenig bitter	5
		5 sehr fein	4,5
Qualität	Qualität	4 fein	4
		3 etwas nachhängend	3,5
		2 nachhängend/breit	3
		1 deutlich nachhängend/breit	2,5
		2 nachhängend/breit	2
		1 deutlich nachhängend/breit	1,5
Präferenz / Reihenfolge (1=Bestes)			
geschätzte BE			

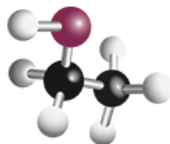
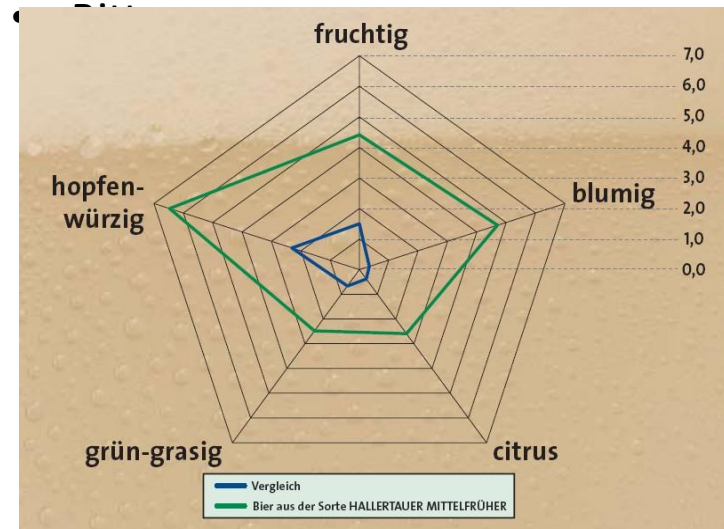
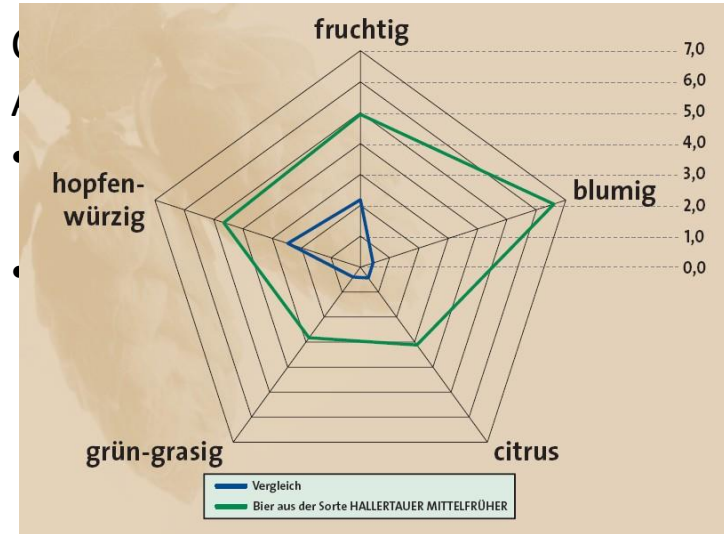
- Qualities evaluated:
- Appearance: color, turbidity
 - Foam: pore size, cling
 - Aroma
 - Taste
 - Harmony: mouthfeel, smoothness
 - Carbonation
 - Bitterness: intensity, quality
 - Preference
 - Sensory bitterness



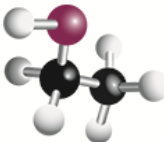
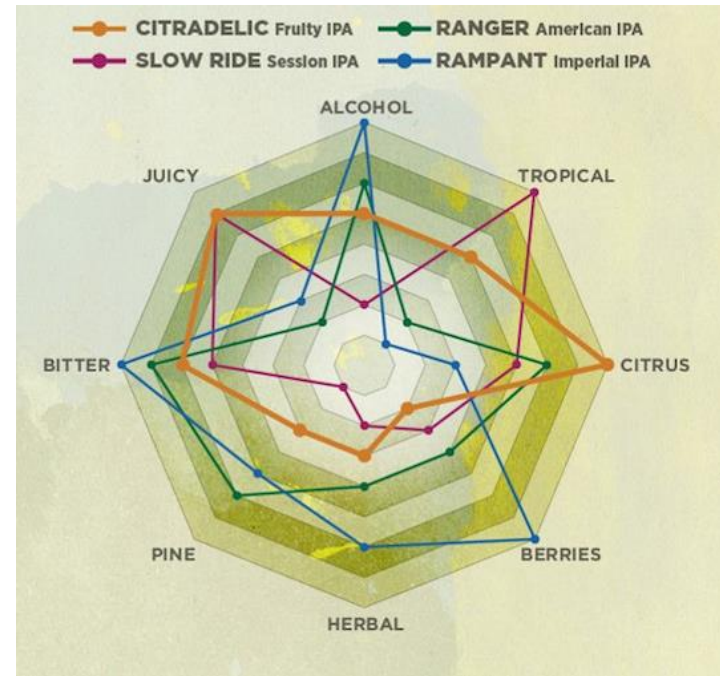
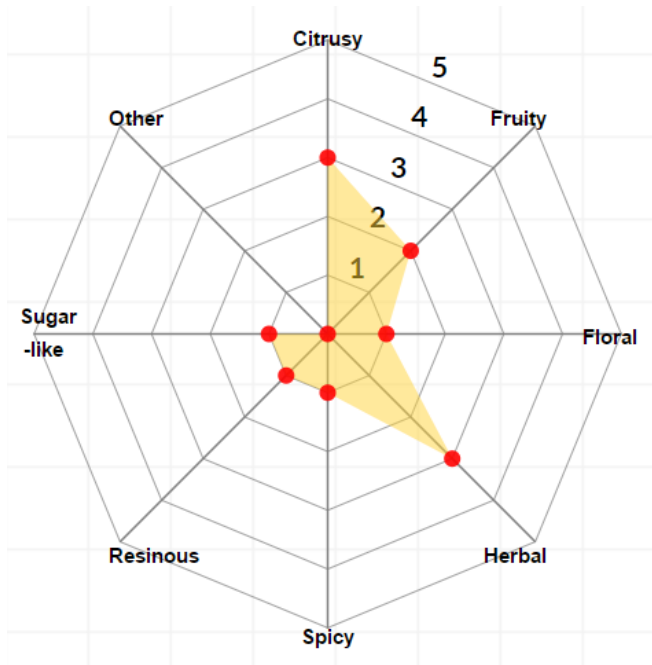
CMA Schema

Hallertauer Mittelfrüh (Aroma & Taste)

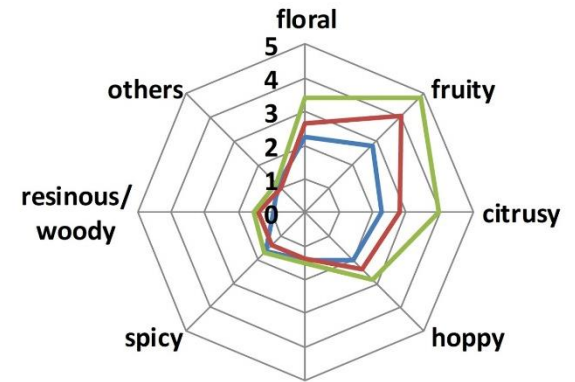
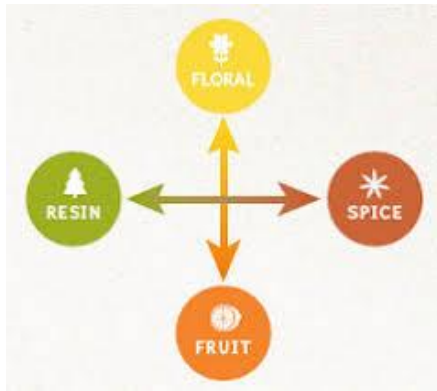
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VERKOSTUNG BRAUVERSUCHE SORTENMAPPE														
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I. Hopfenaroma														
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II. Beschreibung des Hopfenaromas														
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III. Bittere														
Gesamtintensität	<table border="1"> <tr> <td>mild</td><td></td><td>typgerecht</td><td></td><td>kraftig</td> </tr> <tr> <td><input type="checkbox"/></td><td><input type="checkbox"/></td><td><input type="checkbox"/></td><td><input type="checkbox"/></td><td><input type="checkbox"/></td> </tr> </table>	mild		typgerecht		kraftig	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>			
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Other Hop Flavor Languages



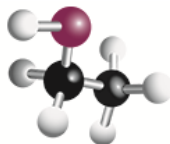
Other Hop Flavor Languages



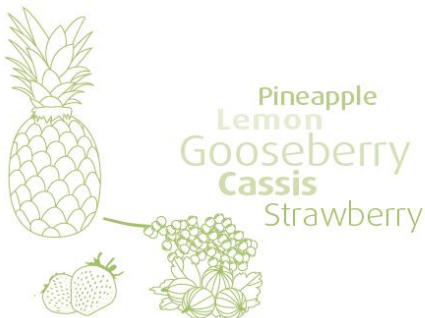
— 2010/08/033 start of boiling — 2010/08/033 whirlpool
 — 2010/08/033 dry hopped

Aroma impressions of beers derived from systematic trial brews
 (mean values independent of beer type)

Fruity	Stone Fruit	Tropical Fruit
Citrus	Floral	Spicy
Tobacco/Earthy	Cedar	Herbal
Pine	Grassy	View All



Barth-Haas Hop Aroma Compendium



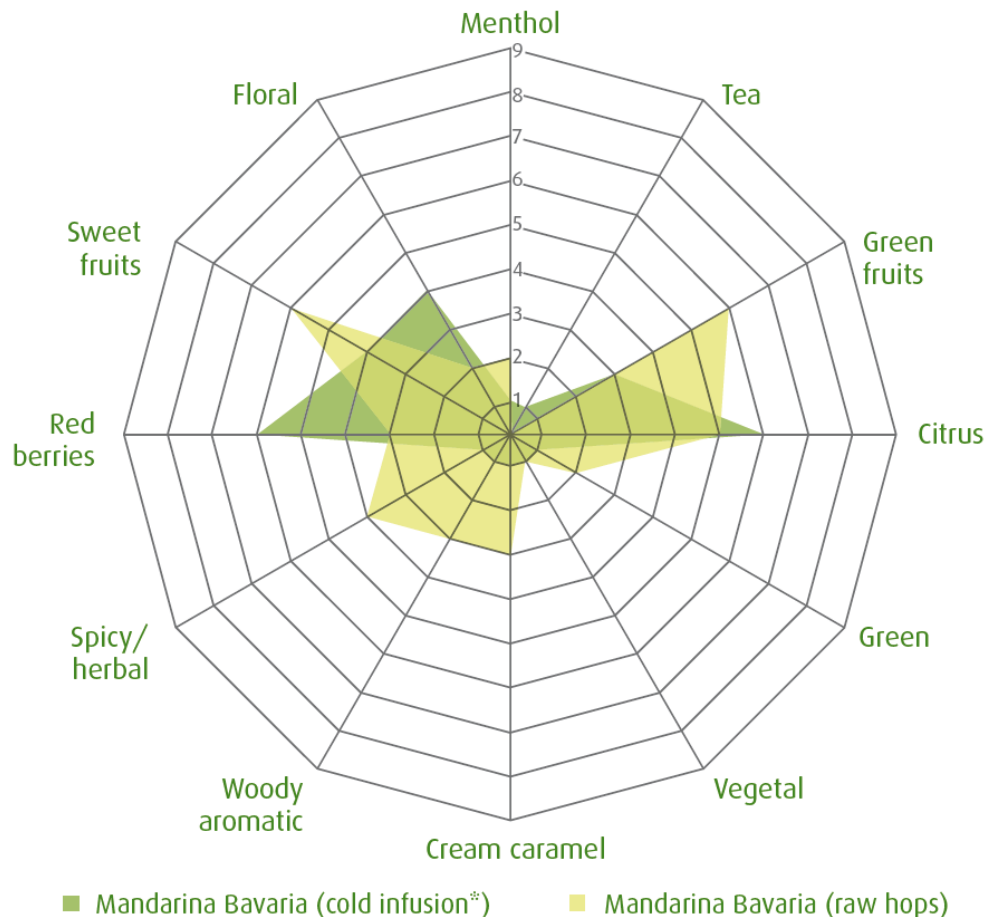
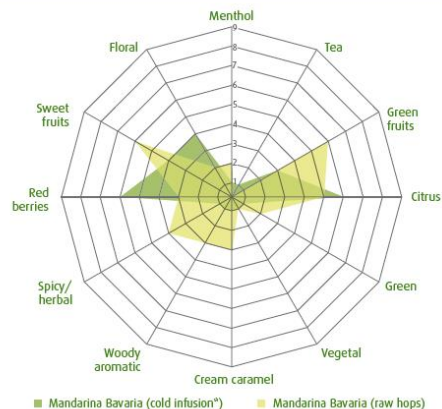
Mandarina Bavaria

Germany



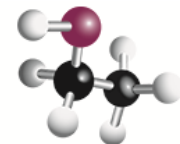
A hop variety with a pleasant fruity aroma and a particularly distinctive tangerine note. The aroma variety was bred in Hüll at the request of the beer industry in light of its demand for bold tastes and new aromas and came onto the market in 2012.

In both the cold infusion and the raw hops Mandarina Bavaria is dominated by citrus notes of grapefruit and lemon, with a flavoursome addition of cassis and redcurrant. In addition, in the raw hops spicy elements such as pepper and exotic pineapple contribute to the flavour profile.



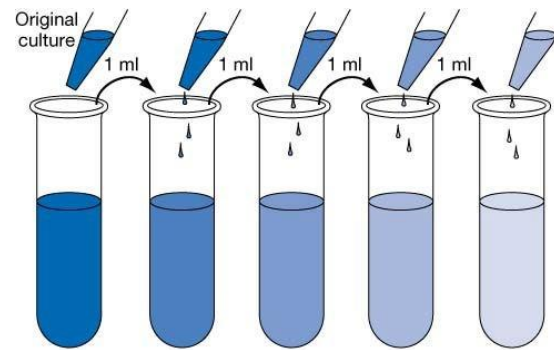
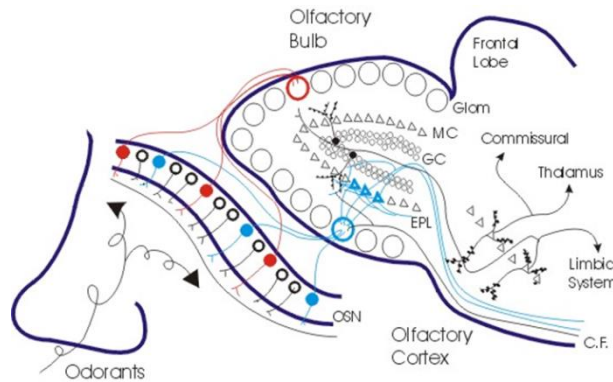
Descriptor	This includes the following aromas:
Menthol	Mint, melissa, sage, metallic, camphor, pine
Tea	Green tea, camomile tea, black tea
Green fruits	Pear, quince, apple, gooseberry, wine yeast, ethereal, grape
Citrus	Grapefruit, orange, lime, lemon, bergamot, lemon grass, ginger, mandarin
Green	Green-grassy, tomato leaves, green peppers, nettel, thuja, basil, parsley
Vegetal	Celeriac, leek, onion, artichoke, garlic, wild garlic
Cream caramel	Butter, chocolate, yoghurt, gingerbread, honey, cream, caramel, toffee, coffee
Woody aromatic	Tobacco, cognac, barrique, hay, leather, tonka, woodruff, incense, myrrh, resin
Spicy/herbal	Lovage, pepper, chilli, curry, juniper, marjoram, tarragon, dill, lavender, aniseed, liquorice, fennel, thyme, rosemary, clove
Red berries	Cassis, blueberries, raspberries, blackberries, strawberries, redcurrants, forest berries
Sweet fruits	Banana, watermelon, honeydew melon, peach, apricot, passion fruit, lychee, dried fruit, plum, pineapple, white jelly bears, cherry, kiwi
Floral	Elderflower, camomile blossom, lily of the valley, jasmine, apple blossom, rose, geranium, carnation, elder

* for the cold infusion 2 gr of pellets was dissolved to 200 ml water (20 °C) for 30 min and subsequently evaluated in order to simulate to some extent the change in aroma through dry hopping.



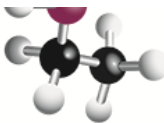
What does aroma mean?

- Aroma → all volatile components of a food or beverage, which are in interaction with our olfactory system
- Highly volatile aromas possess a high vapor pressure at room temperature
- Aroma compounds in food cause the typical aroma of the food
- The (aroma) threshold is the lowest concentration at which an aroma compound can be perceived in a matrix (for most tasters)



- Our sensory memory is a life long training process and is very closely coupled with our emotions. The sensory memory last substantially longer compared to visual ones!

Jelen, H. (2011). Food flavors: Chemical, sensory and technological properties, CRC Press.



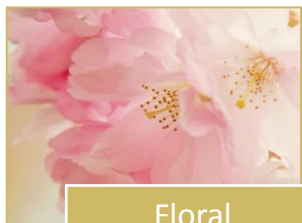
Categorization of Aroma Descriptions

- Linnaeus (1756): Proposed for the first time the categorization of aromas based on the names of plants
- Henning (1915): System of 6 aroma categories with examples for every category
- Crocker und Henderson (1927): System of 4 categories with numerical system for descriptions
- Amooore (1952): System with 7 aroma categories
- Schutz (1964): System with 9 aroma categories
- Wright and Michaels (1964): 8 aroma categories
- Zwaardemaker (1895): 30 aroma categories
- Harper (1968) und Dravnieks (1978): 44 aroma categories



Aroma perception is complex. How does one determine the correct number of aroma categorizations?

Aroma Categorization – Example Perfumer



Floral



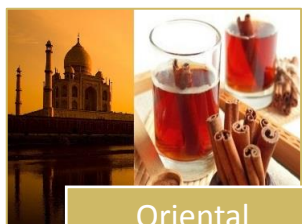
Chypre



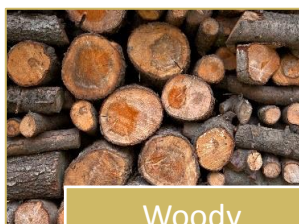
Fougere



Ozonic



Oriental



Woody



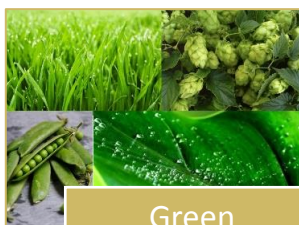
Spicy



Mint



Herbal



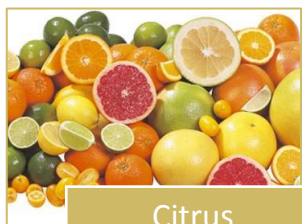
Green



Gourmande



Fruity



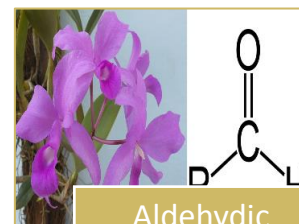
Citrus



Camphoraceous

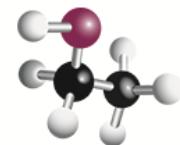


Animalistic



Aldehydic

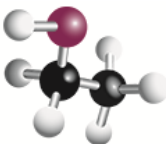
Categories
Frank Rittler
(Perfumer)



Tasting Scheme

BARTH-HAAS GROUP UNIFORM TASTING SCHEME

CATEGORY	SPECIFIC ATTRIBUTES	INTENSITY (1 - 10)	FOR BEER	RATING
FLORAL	Elderflower, camomile blossom, lily of the valley, jasmine, apple blossom, rose, geranium, carnation, lily, lilac, lavender		AROMA INTENSITY (1-10)	
CITRUS	Grapefruit, orange, lemon, lime, bergamot, lemon grass, ginger, tangerine		AROMA QUALITY (1-10)	
SWEET FRUITS	Banana, watermelon, honeydew melon, peach, apricot, passion fruit, lychee, dried fruit, plum, pineapple, cherry, kiwi, mango, guava		BITTER INTENSITY (1-10)	
GREEN FRUITS	Pear, apple, quince, gooseberry, white wine grape		BITTER QUALITY (1-10)	
RED BERRIES	Cassis, blueberry, raspberry, blackberry, strawberry, red currant, black currant, wild strawberry, cranberry		HARMONY (1-10)	
CREAM CARAMEL	Butter, chocolate, yoghurt, honey, cream, caramel, toffee, coffee, tonka bean, vanilla		BODY AND MOUTHFEEL (1-10)	
WOODY AROMATIC	Tobacco, cognac, barrique, leather, woodruff, incense, myrrh, resin, cedar, pine, earth		PREFERENCE	
MENTHOL	Mint, balm, camphor, menthol, wine yeast		ESTIMATED BITTERNESS (IBU)	
HERBAL	Lovage, marjoram, tarragon, dill, parsley, basil, fennel, coriander, rosemary, thyme, green tea, black tea, mate tea, sage			
SPICY	Pepper, chilli, curry, juniper, aniseed, liquorice, fennel seeds, clove, cinnamon, gingerbread, coriander seeds, nutmeg			
GREEN GRASSY	Green grassy, tomato leaves, green pepper, fresh cut grass, hay, nettle, cucumber			
VEGETAL	Celery root, celery stock, leek, onion, artichoke, garlic, wild garlic			

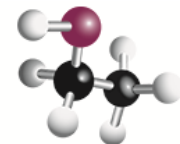


Which aroma categories work well with hops?



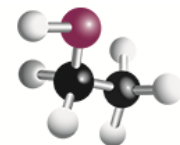
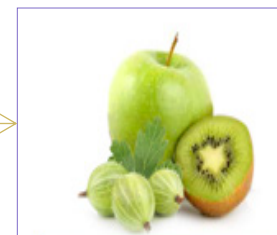
The Language of Hops

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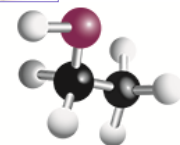
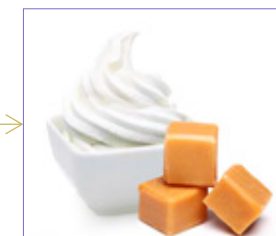
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The Language of Hops

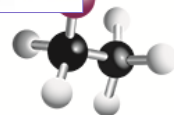
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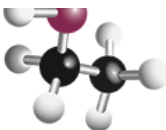
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Variety Examples for Each Category

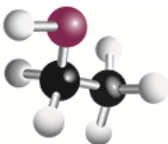
<p>FLORAL</p>  <p>ELLA™</p>	<p>CITRUS</p>  <p>MANDARINA BAVARIA</p>	<p>SWEET FRUITS</p>  <p>MOSAIC®</p>	<p>GREEN FRUITS</p>  <p>HALLERTAU BLANC</p>
<p>RED BERRIES</p>  <p>MONROE</p>	<p>CREAM CARAMEL</p>  <p>TRISKEL</p>	<p>WOODY AROMATIC</p>  <p>RELAX</p>	<p>MENTHOL</p>  <p>POLARIS</p>
<p>HERBAL</p>  <p>SAAZ</p>	<p>SPICY</p>  <p>TAURUS</p>	<p>GREEN GRASSY</p>  <p>HERKULES</p>	<p>VEGETAL</p>  <p>SUMMIT®</p>

Classification according to the dominant aromas that are typical for each hop variety

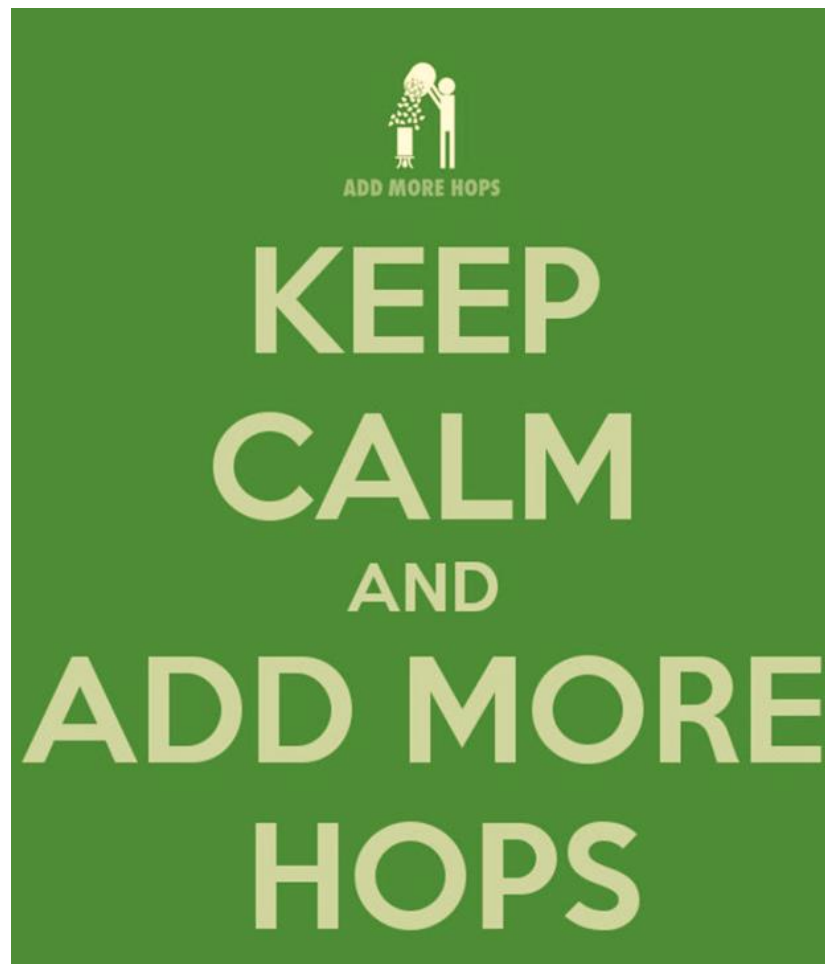


Training for Hop Sensory Analysis

- Work with naturally occurring aromas: fruits, juices, herbs, flowers, etc.
- These are then smelled in covered brown bottles. The aroma is described in your own words. You might even recognize the food.
- Test whether you are able to recognize the food based on your own descriptions.
- Train for all the categories
- Then evaluate hop varieties
- Test whether you recognize the hop varieties based on your own descriptors
- Evaluate hoppy beers as described above



Any Questions?



www.HopsAcademy.com
www.BarthHaasGroup.com

2017 ASBC Meeting

