

WORLD BREWING CONGRESS 2016

The Language of Hops

How to Assess Hop Flavour in Hops and Beer

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(Georg Drexler, Dr. Elisabeth Wiesen, Mark Zunkel, Sebastian Hinz, Alicia Muñoz Insa, Dr. Christina Schönberger, Joh. Barth & Sohn GmbH & Co. KG, Nuremberg, Germany; Victor Algazzali, Tim Kostelecky, John I. Haas Inc., Yakima/Washington D.C., USA)

Introduction

Hops are the soul of beer.

In the last ten years, the 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 the addition of very high amounts for hop aroma in the brewing process in general, the need for a uniform hop sensory language is necessary. Many of the new “flavour hop” varieties like Citra®, Mosaic®, Galaxy™, Mandarina Bavaria, Monroe or Relax don’t allow an accurate evaluation with e.g. only five descriptors as it was done for a long time. If one uses only “citrus”, “floral”, “hoppy”, “fruity” and “herbal”, this is nowadays not enough information to assess the aroma and flavour of these intense hop varieties.

With the help of flavourists and beer sommeliers, we have developed a tasting scheme for hops and hoppy beers that works with defining intensities for twelve aroma categories and identifying specific aroma attributes. This tasting scheme results in a defined aroma profile for the relevant hop variety or beer. It is meant to help speak the same language about hops so that an easier comparison of hop varieties and hoppy beers in a sensory context is possible.

Hopsessed is the sensory teaching program of the Barth-Haas Group – set up as part of the Hops Academy. Everybody who is interested in can attend our *Hopsessed* seminars and learn how to evaluate and describe hops and hop aroma in beers.

BARTH-HAAS/HOPS ACADEMY
All there is to know about hops!

Definition: What is Aroma and Flavour?

Aroma:

- Aroma = any property detected by the olfactory system
- Olfaction is the sensation caused by volatile compounds reaching the olfactory epithelium
- Odor (=aroma) thresholds can be defined as the lowest concentration of a compound in a certain matrix that is sufficient for the recognition
- Recognition of an odor is the comparison of sensory contacts from the surrounding with similar ones kept and stored in memory
- Introduction of an odorant above a certain threshold triggers a response to the stimulus
(Jelen, H., 2011. *Food flavors: Chemical, sensory and technological properties*, CRC Press)



Flavour:

- Flavour is the sensation realized when a food or beverage is placed in the mouth, and the overall sensation of flavour is the result of a combination of responses to receptors present on the tongue and in the mouth, throat and nose
(Woods MP., 1998, “Taste and Flavour Perception”, Proc Nutr Soc.,)
- Flavour is the complex combination of the olfactory, gustatory and trigeminal sensations perceived during tasting
(International Organization for Standardization, ISO 5492:2008; 2008, “Sensory analysis – Vocabulary”)

Differences in Raw Hops and Beer

It is well known that the brewing process has a significant influence on the aroma and flavour expression of a hop variety in beer. The main influencing parameters are time and amount of dosage, yeast strain, fermentation parameters, contact time (for dry hopping), and the filtration process. Even the raw hops show different aromas from year to year or batch to batch due to different growing conditions (this is mainly soil, temperature, precipitation, occurrence of pests & diseases, time of harvest, hop drying and processing, and of course hop and hop product storage).

So it is recommended to not only look at the aroma profile of raw hops, but also to evaluate the hop flavours in beer – and if possible not only in “a” beer, but in “the” beer to which the hops of choice shall be dosed to! This means more work but is crucial to get all the relevant information.

Aroma Categorization

In other sectors like in the wine and food industry, it is common to talk about aromas and flavours with a kind of special language to describe these flavours. But it is difficult to state what is the correct number of aroma classes:

- Linnaeus, 1756, was the first to propose a classification of odors based on named plants
- Henning, 1915, made a system of 6 aroma classes for each of which several examples were quoted
- Crocker and Henderson, 1927, came up with only 4 classes including a numerical system for describing these odors
- Amooore, 1952, used a system with 7 odor classes
- Schutz, 1964, came up with a system consisting of 9 aroma classes
- Wright and Michaels, 1964, used 8 aroma classes
- Zwaardemaker, 1895, used 30 aroma classes
- Harper (1968) and Dravnieks (1978) proposed 44 aroma Classes



(Ernst T. Theimer, 2012, „Fragrance Chemistry – The Science of the Sense of Smell”, Elsevier)

In order to set up a suitable aroma categorization for hops, we were supported by a professional perfumer, Frank Rittler. For flavour description and the development of new perfumes, he uses 16 categories: *Floral, Chypre, Fougere, Ozonic, Oriental, Woody, Spicy, Mint, Herbal, Green, Gourmande, Fruity, Citrus, Camphoraceous, Animalistic, Aldehydic*. This existing categorization was the basis for us to develop a new one – reworked and adjusted to hop flavours. The number of categories was reduced from 16 to 12. The following graph shows these main categories, together with one example of a hop variety. These hop varieties are good representatives of and show strong flavours that fit well into the relevant category; e. g. the hop variety *Mandarina Bavaria* has very intense citrus flavours.

Floral Ella™	Citrus Mandarina Bavaria	Sweet Fruits Mosaic®	Green Fruits Hallertau Blanc
Red Berries Monroe	Cream Caramel Triskel	Woody Aromatic Relax	Menthol Polaris
Herbal Columbus	Spicy Saazer	Grassy-Hay Herkules	Vegetal Summit®

Descriptors and further Attributes

The main descriptors already help us to define the main aroma and flavour of hop varieties. For a more detailed description, it is necessary to take a closer look at further attributes present in the flavour. At first glance, there are some attributes that don’t remind someone of hops, however, all of these were found in one or more hop varieties available.

Intensities of these attributes are to be rated on a scale of 0 to 10. For beer evaluation, additionally other specified attributes, the overall intensity of aroma and bitterness, bitterness units, bitterness quality, harmony, and body & mouthfeel can be useful information to describe the overall quality of a hop variety.

Descriptor	Further Attributes
Floral	Elderflower, Chamomile Blossom, Lily of the Valley, Jasmine, Apple Blossom, Rose, Geranium, Carnation, Lilac, Lavender
Citrus	Grapefruit, Orange, Lime, Lemon, Bergamot, Lemon Grass, Ginger, Tangerine
Sweet Fruits	Banana, Watermelon, Honeydew Melon, Peach, Apricot, Passion Fruit, Lychee, Dried Fruit, Plum, Pineapple, Cherry, Kiwi, Mango, Guava
Green Fruits	Pear, Quince, Apple, Gooseberry, White Wine Grapes
Red Berries	Cassis (Black Currant), Red Currant, Blueberries, Raspberries, Blackberries, Strawberries, Wild Strawberries, Cranberries
Cream Caramel	Butter, Chocolate, Yoghurt, Honey, Cream, Caramel, Toffee, Coffee, Vanilla, Tonka
Woody Aromatic	Tobacco, Cognac, Barrique, Leather, Woodruff, Incense, Myrrh, Resin, Earthy, Cedar, Pine
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, Liquorice, Clove, Ginger Bread, Fennel Seeds
Grassy-Hay	Green-Grassy, Fresh Cut Grass, Hay, Tomato Leaves, Green Peppers, Nettle
Vegetal	Celery Stock, Celery Root, Leek, Onion, Artichoke, Garlic, Wild Garlic

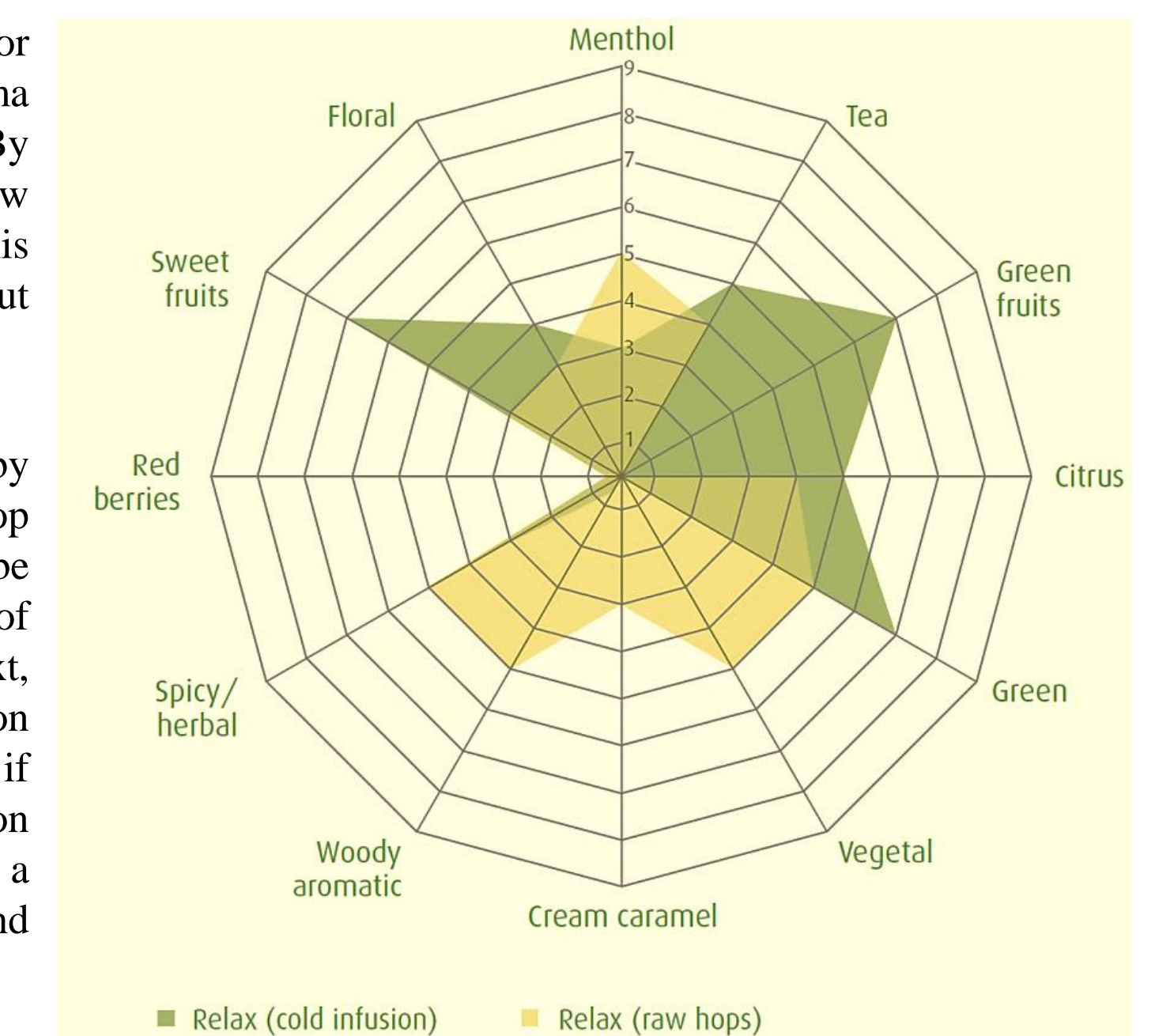
Conclusions

More hoppy beers and new intense hop varieties urge for a more detailed evaluation and description of hop aroma and flavour, both in raw hops, but also in beers. By setting up this new aroma categorization, there are new and better options to do so. The big advantage is that this can be a common language and everybody talks about hop aroma the same in the same way.

Green tea
Celery
Honeydew Melon
Cornflower
Lemongrass



The results gained by this new way of hop evaluation can be presented in form of spider graphs, as a text, or a nice combination of both – it depends if one prefers information at a glance or a comprehensive and detailed description.



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