The range of available hop varieties undergoes constant change as breeding programs bring forth new varieties and older ones are displaced. The purpose of this guide is to categorize new varieties and to enable systematic comparisons and descriptions among varieties. It depicts a total of 22 hop varieties cultivated in the region of Elbe-Saale.

A variety description usually encompasses three fundamental aspects:

- Agronomic properties, in the guide restricted to the two most important characteristics: yield and disease tolerance
- Chemical components including bittering compounds, aromatic compounds and polyphenols
- Sensory evaluation

As sensory description based on standardized terminology is currently not possible, a subjective description of aroma impressions is not included. The perception, specific desires, and personal philosophy of the individual brewer are decisive.

All numbers are averages over many years excluding the normal deviations resulting from influences of crop year, weather, geographic location, etc. The data for 19 varieties are derived exclusively from the Hallertau, whereas data for the local land varieties Spalter and Tettnang originate from their particular production areas of Spalt and Tettnang. Saazer is mainly grown in the region of Elbe-Saale.

Agronomic characteristics:

- Yield in kg/ha. The data reflect official harvest numbers and are based on a 10-year average where applicable.
- Tolerance to wilt, powdery mildew, downy mildew, hop aphids and spider mites is described as low, medium and good, the assessment performed by the Bavarian State Research Center for Agriculture (LfL).

Chemical components:

- All results have been compiled by the AHA (Arbeitsgruppe Hopfenanalyse = Hop Analysis Working Group). The AHA is an association of laboratories of the hop industry and state institutions and is the most authoritative body for hops analysis worldwide. The AHA performs the most important preparatory work for the European Brewery Convention (EBC). The results are based on varying amounts of data. While previous varietal summaries have contained ratios such as that of α- to β-acids, it is more sensible to indicate the reverse ratio of β- to α-acids. This gives a clearer impression of the ratio between important valuable components and the α-acids. As far as possible, official analysis methods were used and are specified.
- Chemical components including bittering compounds, aromatic compounds and polyphenols
- Sensory evaluation

The following data in particular are included:

- α-acids – Method according to EBC 7.4 (lead conductance value); annual publication of the AHA; average over many years; for new varieties with fewer harvests, the average is calculated based on the number of harvests. Values in % w/w.
- β-α-acids; method EBC 7.7 (HPLC); α-acids are an important positive indicator of associated bittering components.
- myrcene – Relative % of α-acids; method EBC 7.7.
- polyphenols – Non specific method EBC 7.14; values in % w/w. The AHA is currently developing an HPLC method, for which some findings have already been published.
- cohumulone – Ratio polyphenols to α-acids (EBC 7.4): values in % w/w, thus dimensionless.
- xanthohumol – Most important hop polyphenol; analysis according to EBC 7.7 (HPLC of bitter acids); values in % w/w, the 2 digits after the decimal point result from the calculated mean.
- linalool – Ratio xanthohumol to α-acids (EBC 7.4: values in % w/w, thus dimensionless).
- total oil – Distillation method (EBC 7.10): values in ml/100g, in steps of 0.05ml/100g for values < 1.0ml/100g and in steps of 0.1ml/100g for values > 1.0ml/100g. The data refer to freshly harvested samples, as hop oil is subject to extensive postharvest losses due to its volatility.
- myrcene; deliberately omitted due to high volatility and unstable data.
- linalool: analysis according to method EBC 7.12 (gas chromatography); – β-caryophyllene: humulene, dimensionless ratio β-farnesene in 4 groups: > 10% fraction of total oil, < 10% fraction of total oil, < 5% fraction of total oil (EBC 7.4): values in mg/g, thus dimensionless.
- linalool: analysis according to method EBC 7.12 (gas chromatography); important indicator of hop aroma in beer; values in mg/kg 100g as is.
- linalool: analysis according to method EBC 7.4: values in mg linalool per g α-acids (mg/g).
Preface to the Second Edition

In 2010, the Pocket Guide was published for the first time for 16 hop varieties grown in Germany. In the meantime, there are four newcomers to the range of breeds from Hall that are grown on a large scale: Hallertauer Blanc, Mandarina Bavaria, Huell Melon and Polaris. In addition, the Saaz variety from the Czech Republic and the Cascade variety from the USA are now grown on significant areas in German growing regions. Therefore this 2nd Edition of the Pocket Guide covers 22 hop varieties. In parallel, the group of varieties like Merkur for example, has lost in significance. Nevertheless, they have been purposely left on the list, because there is still a limited demand for them. The varieties Callista and Ariana, which were only authorized in May 2016, are not included in the list because of the lack of data required to be gathered over several years.

The changes below have been made compared with the 2010 edition.

1. Assignment of Hop Varieties to Groups
In addition to the aroma hop and bitter hop groups, according to the IHGC (International Hop Growers Convention) there are also “dual purpose hops”. A variety from this group can count as a bitter hop but also have special aroma characteristics, like Polaris, for example. In the large group of aroma hops there are additional specifications as to whether a variety can be assigned to the “noble aroma hops” (classic aroma landraces) or the “special flavor hops” (often used for dry hoppings).

2. Storage Stability
All attempts by the AHA (Arbeitsgruppe Hopfenanalyse – Hop Analysis Working Group) to reliably determine the storage stability of hop varieties have so far been unsuccessful. In particular, there is no reliable information about storage over several years. Therefore no specifications are given.

3. Tolerance to Diseases and Pests
Since it is generally considered today that there can be no permanent resistance to diseases and/or pests, we prefer to use the term tolerance instead of resistance. The assessment is restricted to 3 levels, “low, medium and good”, because greater differentiation cannot be put to the test. In addition to the fungal diseases wilt, downy mildew and powdery mildew we have now included the two pests: hop aphids and spider mites.

4. Data
Since the data of the established varieties have hardly changed in the past 6 years no changes have been made compared with the data status of 2010. The only exception is the data of the Hallertauer variety which now have a broader basis and the figures have been changed accordingly.

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The table is explained in detail on the back of the Pocket Guide.

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### 1. Assignment of Hop Varieties to Groups

<table>
<thead>
<tr>
<th>Variety</th>
<th>Spalter</th>
<th>Tettnanger</th>
<th>Hallertauer Mittel</th>
<th>Herbrusser</th>
<th>Saazer</th>
<th>Hallertauer Tradition</th>
<th>Spalter Select</th>
<th>Saphir</th>
<th>Opal</th>
<th>Smaragd</th>
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</thead>
<tbody>
<tr>
<td>Abbreviation</td>
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<td>HB</td>
<td>PE</td>
<td>HT</td>
<td>SE</td>
<td>SR</td>
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### 2. Storage Stability

<table>
<thead>
<tr>
<th>Variety</th>
<th>Cascade</th>
<th>Mandarina Bavaria</th>
<th>Hallertauer Blanc</th>
<th>Huell Melon</th>
<th>Northern Brewer</th>
<th>Hallertauer Magnus</th>
<th>Hallertauer Taurus</th>
<th>Hallertauer Merkur</th>
<th>Herkules</th>
<th>Polaris</th>
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<td>TB</td>
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### 3. Tolerance to Diseases and Pests

<table>
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<th>Variety</th>
<th>Tender</th>
<th>Medium</th>
<th>Good</th>
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<tbody>
<tr>
<td>wilt</td>
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<td>medium</td>
<td>high</td>
</tr>
<tr>
<td>hop aphids</td>
<td>low</td>
<td>medium</td>
<td>high</td>
</tr>
<tr>
<td>spider mites</td>
<td>low</td>
<td>medium</td>
<td>high</td>
</tr>
</tbody>
</table>

### 4. Data

<table>
<thead>
<tr>
<th>Variety</th>
<th>Spalter</th>
<th>Tettnanger</th>
<th>Hallertauer Mittel</th>
<th>Herbrusser</th>
<th>Saazer</th>
<th>Hallertauer Tradition</th>
<th>Spalter Select</th>
<th>Saphir</th>
<th>Opal</th>
<th>Smaragd</th>
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</thead>
<tbody>
<tr>
<td>Yield (kg/ha)</td>
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<td>1900</td>
<td>1600</td>
<td>2200</td>
<td>2000</td>
<td>2000</td>
<td>2700</td>
<td>2200</td>
</tr>
</tbody>
</table>

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