The Soul of Beer
Malting Barley from Germany

New malting barley varieties
New varieties 2008:
- Lisanne
- Quench

BRAUGERSTEN-GEMEINSCHAFT e.V.
Malting barley and the malt made from it, appreciatively called the “soul of beer” by brewers, offers optimal conditions for trouble free and high quality processing in the malthouse and brewery due to its composition and quality properties.

The knowledge that malted grain is specially suited for brewing of beer has been developed and finally was laid down in Germany in the Reinheitsgebot or purity law, which is the world’s oldest surviving food regulation.

Until the middle ages, nearly every type of grain was used for brewing in Germany. However, due to three decisive properties, barley became the most popular main raw material. Husked grain protects the embryo and the barley grain from mechanical damage during malting, serves as a filter layer in the brewery for filtering the mash and out of all types of grains, barley has the highest alpha and beta amylase activity, which ensures rapid saccharification of the starch.

As a result of the constantly rising demands of brewing technology, modern malting barley varieties today have significant properties offering decisive advantages with regard to brewing value and beer quality, such as low protein content between 9.5% and 11.5%, high germinitive capacity, good modification, high extract content and final attenuation. Approximately 60% of the quality properties of a beer are the result of the use of 100% top-quality brewing malt in its production.

The most important, naturally favourable producing regions for malting barley in Germany are locate in Bavaria, Thuringia, Saxony, Baden-Wuerttemberg, Rhineland Palatinate and Lower Saxony. Here, malting barley is cultivated as a special crop exclusively assigned for brewing purposes.

German malting barley and German malt completely fulfil the demands with regard to brewing value and beer quality. The basis for this outstanding raw material quality is close cooperation between malting barley breeders, specialised cropping farms, associations for promoting malting barley, the collectors, traders, maltsters and breweries in addition to thorough testing and approval of varieties by the Bundessortenamt.

Institutes for brewing technology in Berlin and Weihenstephan support breeding, cultivation and processing. This gives the beer nation of Germany the best prerequisites for the production of quality malting barley.

In recent years, the development of new quality malting barley varieties has advanced rapidly. An extensive spectrum of malting barley varieties is available nowadays enabling the production of a wide range of highest quality beer types with unique characteris-
tics. The Malting Barley Variety Portfolio produced by the CMA Centrale Marketing-Gesellschaft der deutschen Agrarwirtschaft mbH and the Braugersten-Gemeinschaft e.V. documents the performance of German malting barley varieties and their processing to malt and beer. The cultivation and refinement of German malting barley to various types of brew malt is acknowledged by the domestic brewing industry and around the world as well. With an export share of roughly 20% of domestic malt production, brewers’ malt from Germany, made from quality malting barley, is a fixed element in the recipes of breweries worldwide.
Plant breeding is a key tool for optimizing crops and adapting them to the changing environment, the shifting desires of consumers and the growing demands of the processing industry. Farmed crops originated from at first unintentional and later intentional selection from wild plants. In the late 19th century, Gregor Mendel recognized the laws of genetics and laid the foundations for scientific breeding. The objectives of breeding malting barley, in addition to improving its agronomic properties such as resistance, yield and quality characteristics, are primarily ease of processing in malthouse and brewery and the quality of the constituents, which have an influence on the flavour stability and composition of the beers.

The accomplishments of malting barley breeding, which has been carried out in Germany for over 100 years, are substantial. For example, the yield of malting barley varieties has been increased considerably. While in the past, high yield was given priority, today stability of yield and suitable quality are also on top of the list of breeding objectives.

Nevertheless, it takes years for breeding and testing by various institutions before a new malting barley variety is accepted by the processing industry and attains an established market share.

The following overview illustrates the stages a newly bred variety has to pass before it is approved and ready for being marketed.

In Germany, malting barley breeding is chiefly carried out by medium-sized enterprises. Breeding is conducted using traditional cross breeding, which is accelerated and supported by biotechnological methods. In the traditional course of breeding, approximately 10 to 12 years of work are required until a new variety is approved. This long period can be shortened by 2 to 3 years using bi-haploid plants or marker-supported selection. In addition, by breeding winter generations of
Breeding of Malting Barley

Scheme of a new breed of cereal

Parental generation (hybrid)

F₁ generation

F₂ generation

F₂ - F₆ Selection generation

F₇ - F₁₀
- Formation of pure lines
- Testing generation
- Commencement of reproduction breeding

F₁₁ - F₁₃
- Official testing
- Line propagation
- Systematic reproduction breeding

Approx. F₁₄
- Approval
- Propagation
- Sub-lines
- Systematic successful breeding

Cereal = self-fertilizing

Variety

Field propagation

and so forth
Breeding of Malting Barley

spring barley under glass and during the summer in the southern hemisphere additional generations can be produced per calendar year, thereby accelerating the breeding process.

The life cycle of the malting barley varieties, presently on the market has become ever shorter in recent years. Varieties like Alexis, Scarlett and Barke, for instance, held a major share of the total crop area in Germany for 10 years and more. Today, the breeding progress of new malting barley varieties is honoured more rapidly by maltsters and brewers. The test schedule of the Berliner Programm, in particular its large-scale on-site experiments,
Breeding of Malting Barley make a substantial contribution to improving the flow of information about the processing properties of new malting barley varieties. This supports fast decisions for selection. With simultaneous seed propagation, the market launch of a new variety can be spurred on promptly upon approval by the Bundessortenamt.

Innovation Cycle in Years

Corporate research

Joint research

Academic research

Basic research

Variety development

Variety testing

Variety approval

Seed production

Source: BDP, Bonn
For over 40 years, the Braugersten-Gemeinschaft e.V. has provided the malting and brewing industries with comprehensive data and research results on quality malting barley. One focal point of the research is constant evaluation of newly approved varieties. Primarily spring barley varieties were tested for their malting and brewing suitability, at first as part of the Frankfurter Programm and since 1995 as part of the Berliner Programm, and the results published in the Braugersstenjahrbuch (Annual Malting Barley Manual).

In view of the growing cultivation options in agriculture and vast progress made in breeding, the Berliner Programm was reformed under the overall control of the advisory council of the Braugersten-Gemeinschaft.

The reform pursued the following objectives:
- To integrate all parties involved in the value chain (breeders, farmers, maltsters and brewers)
- To provide valid results as early as possible following variety approval by the Bundessortenamt
- To evaluate varieties based on the results
- To improve the informative value of the results
- To improve information flow

During the reform, the Berliner Programm was designed so that assessment by the brewing and malting industries on the variety’s process suitability can be made directly after the decision is taken to approve a malting barley variety by the Bundessortenamt. The variety recommendation is based on the study results from the value analyses of the Bundessortenamt, the results of LFL on grain anomalies, the semi-industrial trials and the large-scale on-site experiments in malthouses and breweries at various German locations. Market introduction and market acceptance of the newly approved malting varieties are thereby put into practice more quickly, making breeding progress available to the entire value chain as soon as possible.

### Micromaltings

#### Value analysis of the Bundessortenamt

The results of the micromaltings by the Bundessortenamt are an important element for the decisions taken by the Braugersten-Gemeinschaft. The results (tables and cobweb diagrams) are illustrated in each of the variety datasheets.

#### Variation of the malting parameters

The varieties of the Berliner Programm are malted in the micromalting plant of the Research - Institute for Raw Materials of VLB Berlin on a 1-kg scale. Using a constant steeping and germination period of 6 days, the parameters of the steeping degree and germination temperature are varied:

<table>
<thead>
<tr>
<th>Variant</th>
<th>Steeping degree %</th>
<th>Germination temperature °C</th>
</tr>
</thead>
<tbody>
<tr>
<td>Standard</td>
<td>45</td>
<td>14,5</td>
</tr>
<tr>
<td>Decreasing</td>
<td>45</td>
<td>18,0 → 14,5</td>
</tr>
<tr>
<td>Standard reduced</td>
<td>43</td>
<td>14,5</td>
</tr>
<tr>
<td>Decreasing reduced</td>
<td>43</td>
<td>18,0 → 14,5</td>
</tr>
</tbody>
</table>

The aim of these experiments is to examine the reaction of the new malting varieties to differing tempera-
ture conditions during germination and the reduction of the green malt moisture. The results allow initial conclusions to be drawn with regard to efficiency in industrial malting processes, which are not possible by applying standardised malting conditions alone. Furthermore, the results support to determine suitable malting production methods for the semi-industrial trials on 100- or 200-kg scale. These have to comply with malt specifications laid down in the Berliner Programm.

The test material originates from the cultures commissioned by the Braugersten-Gemeinschaft of six breeder sites in different German cropping regions.

Semi-industrial experiments

By means of semi-industrial malting experiments, trial malts for the ensuing brewing experiments are produced at two institutes (VLB Berlin and TUM Weihenstephan). The barley for these trails originates from the same orthogonal variety experiments from breeder sites already used for the experiments on the variation of malting parameters. The trials are limited to three of the original six experimental sites, which were selected according to weather conditions and harvest time.

Studies in the scope of the Berliner Programm

<table>
<thead>
<tr>
<th>Studies</th>
<th>Material</th>
<th>Provided by</th>
<th>Conducted by</th>
</tr>
</thead>
<tbody>
<tr>
<td>Agronomic properties</td>
<td>WP I-III</td>
<td>Bundessortenamt</td>
<td>Bundessortenamt</td>
</tr>
<tr>
<td>Barley trials</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Physical and chemical grain properties</td>
<td>WP I-III</td>
<td>Bundessortenamt</td>
<td>VLB, Chair for Technology of Brewery I, LfL</td>
</tr>
<tr>
<td>Propensity to grain anomalies</td>
<td>WP II-III</td>
<td>Bundessortenamt</td>
<td>LfL</td>
</tr>
<tr>
<td>Barley trials of the breeders material</td>
<td>Breeders material</td>
<td>Breeder</td>
<td>Chair for Technology of Brewery I</td>
</tr>
<tr>
<td>Micromalting</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Value analysis</td>
<td>WP I-III</td>
<td>Bundessortenamt</td>
<td>VLB, Chair for Technology of Brewery I, LfL</td>
</tr>
<tr>
<td>Standard micromalting with varied germination parameters</td>
<td>Breeders material</td>
<td>Breeder</td>
<td>VLB, Chair for Technology of Brewery I</td>
</tr>
<tr>
<td>Microbrews</td>
<td>WP II</td>
<td>Bundessortenamt</td>
<td>Chair for Technology of Brewery I</td>
</tr>
<tr>
<td>Semi-industrial trials</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Semi-industrial malting 200 kg</td>
<td>Breeders material</td>
<td>Breeder</td>
<td>Chair for Technology of Brewery I</td>
</tr>
<tr>
<td>Semi-industrial malting 100 kg</td>
<td>Breeders material</td>
<td>Breeder</td>
<td>VLB</td>
</tr>
<tr>
<td>Semi-industrial brews</td>
<td>Breeders material</td>
<td>Breeder</td>
<td>Chair for Technology of Brewery I</td>
</tr>
<tr>
<td>Analysis of brewing house parameters</td>
<td>Breeders material</td>
<td>Breeder</td>
<td>VLB</td>
</tr>
<tr>
<td>Large-scale on-site experiments</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>On-site malting 150 MT</td>
<td>Commercial barley trials</td>
<td>Grain trade</td>
<td>Maltsters, Chair for Technology of Brewery I</td>
</tr>
<tr>
<td>On-site processing to finished beer, approx. 6000hl</td>
<td>Commercial barley trials</td>
<td>Maltsters</td>
<td>Breweries, Chair for Technology of Brewery I</td>
</tr>
</tbody>
</table>

The narrow chronological sequence for the individual trials is regulated in a specification sheet.
Chronological sequence of the trials in the scope of the Berliner Programm

**Earliest possible provision of results**

- Value analysis 1: 50*
- Value analysis 2: 20
- Value analysis 3: 6–10
- Approval: 3–6
- Selection: 2–3

- Cultivation by breeder

- Studies at the VLB Berlin
- Studies by the technology chair of brewery I

* Number of tested varieties

**Improved informative value of the results**

- Value analysis 3
- Approval
- Selection

- Microbrews
- Micromalting
- Micromalting VdK

- Semi-industrial experiments
- Sites chosen early October

- Reduction by non-approved varieties

- Studies at the VLB Berlin
- Studies by the technology chair of brewery I

All varieties grown by breeders at six sites
The minimum requirements for important quality parameters of the trial malts are laid down in the specification sheet. In order to fulfil the specifications, the malting parameters are set for each of the barley varieties based on the results of the maltings with varying malting conditions. At VLB Berlin, the semi-industrial brews are followed up to the stage of wort, in order to describe the influence of the varieties on the brewhouse performance by a replicate trial. At Technical University Weihenstephan, the brews are followed till finished beer.

With the malts produced in this manner, brewing experiments on a semi-industrial scale are conducted as replicate trial according to the following scheme:

**Infusion mashing methods (relation 3:1)**

<table>
<thead>
<tr>
<th>Step</th>
<th>Temperature</th>
<th>Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mashing</td>
<td>62 °C</td>
<td></td>
</tr>
<tr>
<td>Rest phase</td>
<td>62 °C</td>
<td>40 min</td>
</tr>
<tr>
<td>Heating</td>
<td>72 °C</td>
<td>10 min</td>
</tr>
<tr>
<td>Rest phase</td>
<td>72 °C</td>
<td>30 min</td>
</tr>
<tr>
<td>Heating</td>
<td>76 °C</td>
<td>4 min</td>
</tr>
<tr>
<td>Rest phase</td>
<td>76 °C</td>
<td>10 min</td>
</tr>
<tr>
<td>Final mashing</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Lautering conditions**

<table>
<thead>
<tr>
<th>Step</th>
<th>Duration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lauter rest phase</td>
<td>10 min</td>
</tr>
<tr>
<td>Pump first wort</td>
<td>15 min</td>
</tr>
<tr>
<td>Flow rate</td>
<td>40 l/h</td>
</tr>
<tr>
<td>Adjustment of lauter valve</td>
<td>variable</td>
</tr>
<tr>
<td>Raking</td>
<td>if needed</td>
</tr>
<tr>
<td>Sparging</td>
<td>continuous</td>
</tr>
</tbody>
</table>

The objective of these brewing experiments is to assess parameters affecting the brewhouse -yield and to record relevant process parameters for characterizing the lauter behaviour of the malts. Thus experiments final wort production.

Based on all relevant data, available after completion of the brewing experiments, the Variety Committee of Braugersten-Gemeinschaft establishes a description of the individual variety characteristics for each of the malting barley varieties newly approved by the Bundessortenamt. A summarizing assessment for the selection of varieties for the following large-scale field cultivation is provided. The summarized assessments are illustrated on the respective variety datasheets in the Malting Barley Variety Portfolio.

**Composition of the varieties committee of the Braugersten-Gemeinschaft e.V.**

- **Brewing industry:** 4 representatives
- **Malting industry:** 4 representatives
- **Institutes:** 3 representatives
- **Bundessortenamt:** 1 representative
- **Agricultural advisors:** 2 representatives
- **Braugersten-Gemeinschaft:** Chairman

Test seal of the Braugersten-Gemeinschaft for recommended varieties from the Berliner Programm
Annabell

**Breeder:** Dr. J. Ackermann & Co.
**Origin:** 90014 DH x Krona
**Bundessortenamt number:** GS 1749
**Year of approval:** 1999

**Agronomic properties:**
Medium maturity, good stem stability, medium susceptibility to diseases. High tillering rate capacity results in high crop density and medium to high yields. Good percentage of screening above 2.5 mm.

**Barley quality:**
Medium kernel size, low propensity to sprouting.

**Malt quality:**
Medium to good extract with average final attenuation. Outstanding cytolysis with moderate proteolysis. Low amylolytic potential and low Diastatic Power. Low beta-glucan values with low viscosity.

**Wort quality:**
Good yield, good proportion of nitrogen, low viscosity, low beta-glucan values, good to very good lautering times.

**Beer quality:**
Very good tasting results with strikingly delicate and well balanced beer character. Medium head retention and above-average stability.

**Weighted quality summary**
- **Bitterness**: 4.1
- **Freshness**: 3.6
- **Full bodiness**: 4.6
- **Flavour**: 4.6
- **Odour**: 4.6

Data for one year

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**Beer quality**

- **Odour**: 4.6
- **Weighted quality summary**: 4.1
- **Flavour**: 3.6
- **Freshness**: 4.6
- **Full bodiness**: 3.6

**Data for one year**

- **Annabell**: 4.1, 3.6, 4.6
- **Scarlett**: 4.1, 3.6, 4.6
**Annabell**

**Breeder:** Dr. J. Ackermann & Co.
**Origin:** 90014 DH x Krona
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**Beer quality summary**

**Data for one year**

<table>
<thead>
<tr>
<th></th>
<th>Annabell</th>
<th>Scarlett</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Bitterness</strong></td>
<td>4.1</td>
<td>4.1</td>
</tr>
<tr>
<td><strong>Freshness</strong></td>
<td>3.6</td>
<td>3.6</td>
</tr>
<tr>
<td><strong>Full bodiness</strong></td>
<td>4.6</td>
<td>4.6</td>
</tr>
<tr>
<td><strong>Flavour</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Odour</strong></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Brewing malt from Annabell supplies medium to good extract with normal final attenuation. Excellent cytolysis is seen alongside moderate proteolysis. The marginal amylolytic potential is reflected in low Diastatic power. Favourable beta-glucan values and low viscosity can also be achieved using short malting. Compared to the variety Scarlett, Annabell leans towards high wort col-ours in addition to a lower Kolbach index. Its extract only just reaches Scarlett’s level. Its final attenuation is assessed as good.

Processing malt from Annabell is unproblematic in every respect. A good supply of nitrogen and low viscosity ensure high wort quality with very good cloud-ing. The low beta-glucan levels ensure good lauter times and very good data during fil-tration. Compared with the variety Scarlett, its brewery yield can be assessed as medium to good.

Sensory assessments of beers made with Annabell are outstanding. The delicate and yet full character makes it an especially suitable malting barley for pale beers and Pilsner type beers. The head retention of beer brewed with Annabell lies in the average of the refer-ence brews made using other malting varieties.
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**Auriga**

**Breeder:** Dr. J. Ackermann & Co.  
**Origin:** (Viskosa x Krona) x Annabel  
**Bundessortenamt number:** GS 1915  
**Year of approval:** 2002

**Agronomic properties:**  
Very early maturity, good stem stability, medium to low susceptibility to diseases, favourable protein content with good screening above 2.5 mm

**Wort quality:**  
Medium extract yield, well-balanced proportion of nitrogen fractions. Slightly increased beta-glucan values with medium viscosity.

**Barley quality:**  
Medium to large kernels, low propensity to sprouting.

**Malt quality:**  
Average extract with very high final attenuation. Cylolysis and proteolysis are well balanced. Medium alpha-Amylase activity, high Diastatic Power.

**Beer quality:**  
Very good head retention, good tasting results with strikingly good body and well-balanced bitterness. Average to good stability.

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**Beer quality summary**

- **Bitterness**: 4.05  
- **Freshness**: 4.00  
- **Full bodiness**: 4.10  
- **Flavour**: 4.15  
- **Odour**: 4.20

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**Pasadena**

**Auriga**

Data for one year

Weighted quality summary

- **Bitterness**: 4.05  
- **Freshness**: 4.00  
- **Full bodiness**: 4.10  
- **Flavour**: 4.15  
- **Odour**: 4.20
Auriga

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Bundessortenamt number: GS 1915
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Weighted quality summary

- Bitterness
- Freshness
- Full bodiness
- Flavour
- Odour

Data for one year

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- Freshness: 4.00
- Full bodiness: 4.10
- Flavour: 4.15
- Odour: 4.20

Auriga

Pasadena

Daten einjährig gewichtete Note

- Bittere: 4.05
- Rezenz: 4.00
- Vollmundigkeit: 4.10
- Geschmack: 4.15
- Geruch: 4.20
Auriga

The very early maturing variety Auriga is distinguished by good resistance properties to mildew and dwarf rust. Its susceptibility to rhynchosporium as well as to non-parasitic leaf brown- ing can impair the good and stable yield. Auriga is dis- tinguished by a favourable protein content and good percentage of grade barley. Its very high germination energy positively rounds off its good processing traits in the maltster.

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**Malt quality**

Brewing malt made from Auriga supplies average extract with very high final attenuation. A balanced ratio of cytolysis and proteolysis results in stable results in various malting methods. Even with slightly increased protein levels, Auriga supplies very pale malts with low viscosity. With its medium alpha-amylase activity, at the same time Auriga displays very high Diastatic power.

**Processing parameters**

Processing malt from Auriga results in high extract yields with well-balanced nitrogen levels and good clouding levels. The slightly increased beta-glucan levels are not problematic for processing during lauter- ing and filtration and deliver very good head retention. Good extracts levels are implemented in a medium ex- tract yield.

**Head morphology**

- Glaucosity: medium to strong
- Attitude: semi-erect to horizontal
- Rows: two-rowed
- Density: medium
- Length: medium

**Kernel morphology**

- Pubescence of the rachilla: long
- Husk: present
- Anthocyanin colouration of the lemma nerves: very little to little
- Spiculation of the inner dorsal lemma nerves: medium to strong
- Pubescence of the ventral furrow: none
- Colour of the aleurone layer: whitish

**Head retention**

The head retention of beer brewed with Auriga is very good compared to other brews made with other malt- ing varieties. During tasting, the full body and balanced bitterness stood out positively. The overall assessment of the tasting lies in the average and displays no peaks or outliers in individual evaluation criteria.
Auriga

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**Breeder:** Saatzucht Josef Breun GdB 
**Origin:** Libelle x Alexis
**Bundessortenamt number:** GS 1582
**Year of approval:** 1996

**Agronomic properties:**
Medium maturity, good lodging resistance and stem stability, low to medium susceptibility to diseases, depending on location average to high yield with above-average percentages of screening above 2.5 mm.

**Wort quality:**
Very good extract yield, high final attenuation, good, balanced proportion of nitrogen. Low viscosity, low beta-glucan content.

**Beer quality:**
Very good tasting results, distinct flavour and pleasantly well-balanced bitterness. Medium to good head retention.

**Barley quality:**
Large kernels, low propensity to sprouting.

**Malt quality:**
Average, good extract with medium final attenuation. Well balanced relation of moderate proteolysis and pronounced cytolysis. Low colour formation and post coloration, high Diastatic Power.

---

**Bierqualität**

**Weighted quality summary**

<table>
<thead>
<tr>
<th>Bitterness</th>
<th>Freshness</th>
<th>Full bodiness</th>
<th>Flavour</th>
<th>Odour</th>
</tr>
</thead>
<tbody>
<tr>
<td>4.0</td>
<td>3.5</td>
<td>4.5</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Data for one year

---

**Alexis**

**Bitterness | Freshness | Full bodiness | Flavour | Odour |
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>4.0</td>
<td>3.5</td>
<td>4.5</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Data for one year

---

**Barke**

**Bitterness | Freshness | Full bodiness | Flavour | Odour |
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>4.0</td>
<td>3.5</td>
<td>4.5</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Data for one year
Barke

Breeder: Saatzucht Josef Breun GbR
Origin: Libelle x Alexis
Bundessortenamt number: GS 1582
Year of approval: 1996

**Beer quality**

- **Odour**: 4.0
- **Flavour**: 4.0
- **Full bodiness**: 4.5
- **Bitterness**: 3.5
- **Freshness**: 3.5

**Agronomic properties:**
Medium maturity, good lodging resistance and stem stability, low to medium susceptibility to diseases, depending on location average to high yield with above-average percentages of screening above 2.5 mm.

**Wort quality:**
Very good extract yield, high final attenuation, good, balanced proportion of nitrogen. Low viscosity, low beta-glucan content.

**Barley quality:**
Large kernels, low propensity to sprouting.

**Malt quality:**
Average, good extract with medium final attenuation. Well balanced relation of moderate proteolysis and pronounced cytolysis. Low colour formation and post coloration, high Diastatic Power.

**Beer quality:**
Very good tasting results, distinct flavour and pleasantly well-balanced bitterness. Medium to good head retention.
Barke

On suitable soils, the malt- ing barley variety Barke de- livers good yields. Its me- dium maturity and reliable lodging resistance prove themselves in particular on medium and good locations. Sowing should be done as early as possible. Barke is distinguished by low protein content, very good resist- ance to mildew and dwarf rust and good tolerance to disease. The large kernels and good screening posi- tively round off the good bar- ley quality.

Brewing malt made from Barke supplies good extract with average fi  nal attenuation. A balanced proportion of cytolysis and proteolysis delivers stable results using various malting methods. Barke contributes very pale wort colours and is therefore highly recommended for pale and Pilsner type beers. The low protein content has a favourable effect on the extract. The viscosity levels are slightly higher than those of the compared variety, which, in turn, has a positive effect on head retention.

Processing malt from Barke delivers outstanding ex- tract yields with moderate protein solution and adapted, restrained cell wall modification. A high final attenuation and favourable enzyme content accompanied by a pale colour makes it an all-round talent for processing. Both the lauter times and clouding levels are outstanding. Due to its balanced quality, Barke served as the variety used to calculate yield and brewing quality during the value analyses of the Bundessortenamt.

The head retention of beer brewed from Barke is higher than the average of the reference beers made with other malting barley varieties. The tasting results are also balanced and above average. The beers are markedly pleasant, have a distinctive flavour and well- rounded bitterness. Within the average of the com- pared brews, they display no peaks or outliers in indi- vidual evaluation criteria.
Barke

On suitable soils, the malting barley variety Barke delivers good yields. Its medium maturity and reliable lodging resistance prove themselves in particular on medium and good locations. Sowing should be done as early as possible. Barke is distinguished by low protein content, very good resistance to mildew and dwarf rust and good tolerance to disease. The large kernels and good screening positively round off the good barley quality.

Brewing malt made from Barke supplies good extract with average final attenuation. A balanced proportion of cytolysis and proteolysis delivers stable results using various malting methods. Barke contributes very pale wort colours and is therefore highly recommended for pale and Pilsner type beers. The low protein content has a favourable effect on the extract. The viscosity levels are slightly higher than those of the compared variety, which, in turn, has a positive effect on head retention.

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The head retention of beer brewed from Barke is higher than the average of the reference brews made with other malting barley varieties. The tasting results are also balanced and above average. The beers are markedly pleasant, have a distinctive flavour and well-rounded bitterness. Within the average of the compared brews, they display no peaks or outliers in individual evaluation criteria.
Belana

**Breeder:** Nordsaat Saatzucht GmbH

**Origin:** Aspen x Annabell

**Bundessortenamt number:** GS 2020

**Year of approval:** 2004

---

**Agronomic properties:**
Medium maturity, good stem stability, low susceptibility to diseases, high plant density and high yield. Good percentage of screening above 2.5 mm.

**Wort quality:**
Very good extract yield with below-average final attenuation. Good nitrogen content and high content of total polyphenols. Medium to high viscosity.

**Barley quality:**
Medium to large kernels, low propensity to sprouting.

**Malt quality:**
Good extract with medium final attenuation. Balanced proportion of cytolysis and proteolysis. Low amylolytic potential, medium beta-glucan values.

**Beer quality:**
Average tasting results. Medium head retention and below-average stability.
Belana

**Breeder:** Nordsaat Saatzucht GmbH

**Origin:** Aspen x Annabell

**Bundessortenamt number:** GS 2020

**Year of approval:** 2004

**Agronomic properties:**
Medium maturity, good stem stability, low susceptibility to diseases, high plant density and high yield. Good percentage of screening above 2.5 mm.

**Wort quality:**
Very good extract yield with below-average final attenuation. Good nitrogen content and high content of total polyphenols. Medium to high viscosity.

**Barley quality:**
Medium to large kernels, low propensity to sprouting.

**Malt quality:**
Good extract with medium final attenuation. Balanced proportion of cytolysis and proteolysis. Low amylolytic potential, medium beta-glucan values.

**Beer quality:**
Average tasting results. Medium head retention and below-average stability.

### Data for one year

<table>
<thead>
<tr>
<th>Weighted quality summary</th>
<th>Bitterness</th>
<th>Rezenz</th>
<th>Vollmundigkeit</th>
<th>Geschmack</th>
<th>Geruch</th>
</tr>
</thead>
<tbody>
<tr>
<td>Belana</td>
<td>4.1</td>
<td>4.0</td>
<td>4.2</td>
<td>4.3</td>
<td></td>
</tr>
<tr>
<td>Pasadena</td>
<td>4.0</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Beer quality**

- **Odour**
  - Belana: 4.3
  - Pasadena: 4.2
- **Flavour**
  - Belana: 4.3
  - Pasadena: 4.3
- **Full bodiness**
  - Belana: 4.0
  - Pasadena: 4.0
- **Freshness**
  - Belana: 4.1
  - Pasadena: 4.0

**Pasadena**

<table>
<thead>
<tr>
<th>Weighted quality summary</th>
<th>Bitterness</th>
<th>Rezenz</th>
<th>Vollmundigkeit</th>
<th>Geschmack</th>
<th>Geruch</th>
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<td>Belana</td>
<td>4.1</td>
<td>4.0</td>
<td>4.2</td>
<td>4.3</td>
<td></td>
</tr>
<tr>
<td>Pasadena</td>
<td>4.0</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Belana

**Agronomic properties**

The very adaptable variety Belana is suited to all locations, in particular also for weaker locations and high altitudes. Belana is a short-stemmed malting barley with good lodging resistance and medium maturity. Very good resistance properties result in low susceptibility to disease. The high crop density ensures for consistently good yields.

**Malt quality**

Brewing malt made from Belana supplies good extract with medium final attenuation. A balanced proportion of cytolysis and proteolysis delivers stable results using various malting methods. Somewhat higher beta-glucan levels are observed after shorter malting. In spite of the relatively low amylolytic potential, its processing characteristics are outstanding and balanced and its viscosity is very good. With higher protein content, Belana tends to produce higher wort colours during processing. The extract yield is above average.

**Processing parameters**

Processing malt from Belana results in worts with high, yet below average final attenuations. Good nitrogen content and high content of total polyphenols ensure good wort quality. Yields are good. In spite of very low viscosity, the lauter times and filterability are slightly increased.

**Head morphology**

- **Glaucosity**: strong
- **Attitude**: horizontal
- **Rows**: two-rowed
- **Density**: medium
- **Length**: short

**Kernel morphology**

- **Pubescence of the rachilla**: short
- **Husk**: present
- **Anthocyanin colouration of the lemma nerves**: strong
- **Spiculation of the inner dorsal lemma nerves**: none
- **Pubescence of the ventral furrow**: none
- **Colour of the aleurone layer**: whitish

**Head retention**

The head retention of beer brewed with Belana lies in the average of the reference brews made with other malting barley varieties. The evaluation in the force test lies far behind that of the comparison. The tasting results are also within the average of reference brews, however, they display considerable deviations from the comparison beers in some criteria.
Belana

The very adaptable variety Belana is suited to all locations, in particular also for weaker locations and high altitudes. Belana is a short-stemmed malting barley with good lodging resistance and medium maturity. Very good resistance properties result in low susceptibility to disease. The high crop density ensures for consistently good yields.

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Braemar

**Breeder:** Cebeco  
**Origin:** NFC 5563 x NFC 94-20  
**Bundessortenamt number:** GS 1926  
**Year of approval:** 2002

**Agronomic properties:**  
Medium maturity, good stem stability, medium susceptibility to disease, average to high yield with slightly above-average of screening above 2.5 mm.

**Barley quality:**  
Medium to large kernels, low propensity to sprouting.

**Malt quality:**  
Average extract with high final attenuation. Moderate proteolysis with simultaneous good cytolysis. Despite of slightly lower alpha-Amylase activity, high Diastatic Power.

**Wort quality:**  
Good yield, good ratio of high molecular/total nitrogen, medium viscosity, low beta-glucan content.

**Beer quality:**  
Very good tasting results with strikingly good body and well-balanced bitterness. Good head retention and above-average stability.

**Beer quality summary**

<table>
<thead>
<tr>
<th></th>
<th>Braemar</th>
<th>Pasadena</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bitterness</td>
<td>4.1</td>
<td>4.0</td>
</tr>
<tr>
<td>Freshness</td>
<td>4.0</td>
<td>3.6</td>
</tr>
<tr>
<td>Full bodiness</td>
<td>4.6</td>
<td></td>
</tr>
<tr>
<td>Flavour</td>
<td>4.1</td>
<td></td>
</tr>
<tr>
<td>Odour</td>
<td>4.3</td>
<td></td>
</tr>
</tbody>
</table>

**Weighted quality summary**

<table>
<thead>
<tr>
<th></th>
<th>Braemar</th>
<th>Pasadena</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bitterness</td>
<td>4.1</td>
<td>4.0</td>
</tr>
<tr>
<td>Freshness</td>
<td>4.0</td>
<td>3.6</td>
</tr>
<tr>
<td>Full bodiness</td>
<td>4.6</td>
<td></td>
</tr>
<tr>
<td>Flavour</td>
<td>4.1</td>
<td></td>
</tr>
<tr>
<td>Odour</td>
<td>4.3</td>
<td></td>
</tr>
</tbody>
</table>
**Braemar**

- **Breeder:** Cebeco
- **Origin:** NFC 5563 x NFC 94-20
- **Bundessortenamt number:** GS 1926
- **Year of approval:** 2002

### Wort quality:
Good yield, good ratio of high molecular/total nitrogen, medium viscosity, low beta-glucan content.

### Beer quality:
Very good tasting results with strikingly good body and well-balanced bitterness. Good head retention and above-average stability.

### Agronomic properties:
Medium maturity, good stem stability, medium susceptibility to disease, average to high yield with slightly above-average of screening above 2.5 mm.

### Barley quality:
Medium to large kernels, low propensity to sprouting.

### Malt quality:
Average extract with high final attenuation. Moderate proteolysis with simultaneous good cytolysis. Despite of slightly lower alpha-Amylase activity, high Diastatic Power.

---

**Beer quality**

- **Odour:**
  - **Braemar:** 4.3
  - **Pasadena:** 4.2

- **Flavour:**
  - **Braemar:** 4.1
  - **Pasadena:** 4.0

- **Full bodiness:**
  - **Braemar:** 4.2
  - **Pasadena:** 4.1

- **Bitterness:**
  - **Braemar:** 4.1
  - **Pasadena:** 4.0

- **Freshness:**
  - **Braemar:** 3.6
  - **Pasadena:** 3.6

- **Data for one year**

---

**Weighted quality summary**

- **Bitterness:**
  - **Pasadena:** 3.6
  - **Braemar:** 3.5

- **Flavour:**
  - **Pasadena:** 4.6
  - **Braemar:** 4.5

- **Full bodiness:**
  - **Pasadena:** 4.6
  - **Braemar:** 4.5

- **Odour:**
  - **Pasadena:** 4.6
  - **Braemar:** 4.5

- **Freshness:**
  - **Pasadena:** 3.6
  - **Braemar:** 3.5
The variety Braemar, which is especially suited to early and medium cropping regions, supplies high yields with slightly above-average percentage of grade barley. Braemar is distinguished by medium maturity, good stem stability, medium susceptibility to disease and average yields.

Brewing malt made from Braemar supplies average extract with high final attenuation. A moderate proteolysis with simultaneous good cytolysis delivers good results using various malting methods. In spite of somewhat low alpha-amylase activity, Braemar has high Diastatic power. Braemar delivers very pale beers with medium viscosity.

Processing malt from Braemar is unproblematic in every respect and results in good yields. In spite of the good proportion of highly molecular nitrogen to total nitrogen, the head values are only medium. High final attenuation and a good supply of nitrogen even with low protein content ensure high wort quality with low beta-glucan content and good lauter properties.

The head retention of beer brewed from Braemar is good compared to comparison brews made with other malting barley varieties. At tasting, the balance of all components and the good body and full bitters were positively assessed. The good overall assessment of the tasting is above average.
The variety Braemar, which is especially suited to early and medium cropping regions, supplies high yields with slightly above-average percentage of grade barley. Braemar is distinguished by medium maturity, good stem stability, medium susceptibility to disease and average yields.

Brewing malt made from Braemar supplies average extract with high final attenuation. A moderate proteolysis with simultaneous good cytolysis delivers good results using various malting methods. In spite of somewhat low alpha-amylase activity, Braemar has high Diastatic power. Braemar delivers very pale beers with medium viscosity.

Processing malt from Braemar is unproblematic in every respect and results in good yields. In spite of the good proportion of highly molecular nitrogen to total nitrogen, the head values are only medium. High final attenuation and a good supply of nitrogen even with low protein content ensure high wort quality with low beta-glucan content and good lauter properties.

The head retention of beer brewed from Braemar is good compared to comparison brews made with other malting barley varieties. At tasting, the balance of all components and the good body and full bitters were positively assessed. The good overall assessment of the tasting is above average.
**Lisanne**

**Breeder:** Limagrain  
**Origin:** Bellevue x Pasadena  
**Bundessortenamt number:** GS 2164  
**Year of approval:** 2006

**Agronomic properties:**  
Medium maturity, good stem stability, low susceptibility to disease, good screening > 2.5 mm (compared with newly approved varieties in 2006)

**Barley quality:**  
Good grading, average protein content, latency not observed.

**Malt quality:**  

**Wort quality:**  
Good yield, good lauter times. Good supply of nitrogen and good viscosity. Good attenuation.

**Beer quality:**  
Good tasting results. Good head retention.

**Beer quality summary**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Lisanne</th>
<th>Pasadena</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bitterness</td>
<td>3.9</td>
<td>4.3</td>
</tr>
<tr>
<td>Rezenz</td>
<td>4.5</td>
<td>4.1</td>
</tr>
<tr>
<td>Vollmundigkeit</td>
<td>4.1</td>
<td>4.7</td>
</tr>
<tr>
<td>Trunk</td>
<td>4.4</td>
<td>4.3</td>
</tr>
<tr>
<td>Geruch</td>
<td>3.9</td>
<td>4.3</td>
</tr>
<tr>
<td>Quench</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Data for one year
Lisanne

**Breeder:** Limagrain  
**Origin:** Bellevue x Pasadena  
**Bundessortenamt number:** GS 2164  
**Year of approval:** 2006

**Agronomic properties:**
Medium maturity, good stem stability, low susceptibility to disease, good screening > 2.5 mm (compared with newly approved varieties in 2006)

**Barley quality:**
Good grading, average protein content, latency not observed.

**Malt quality:**

**Wort quality:**
Good yield, good lauter times. Good supply of nitrogen and good viscosity. Good attenuation.

**Beer quality:**
Good tasting results. Good head retention.

---

### Weighted quality summary

<table>
<thead>
<tr>
<th>Component</th>
<th>Lisanne</th>
<th>Pasadena</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bitterness</td>
<td>3.9</td>
<td>4.3</td>
</tr>
<tr>
<td>Rezenz</td>
<td>4.5</td>
<td>4.1</td>
</tr>
<tr>
<td>Vollmundigkeit</td>
<td>4.1</td>
<td>4.4</td>
</tr>
<tr>
<td>Trunk</td>
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<td>4.7</td>
</tr>
<tr>
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<td>3.9</td>
<td>4.3</td>
</tr>
<tr>
<td>Quench</td>
<td>4.5</td>
<td>4.3</td>
</tr>
</tbody>
</table>

**Data for one year**

**Wort quality:**
Good yield, good lauter times. Good supply of nitrogen and good viscosity. Good attenuation.

**Beer quality:**
Good tasting results. Good head retention.
The variety Lisanne, classified with a medium time of ear emerging, is distinguished by a high thousand-grain weight and by very high plant density. Both of these properties together guarantee consistently high yields. Good resistance, in particular to mildew and Ramularia, combined with low protein content make it a malting barley suited for all locations and climate zones.

Brewing malt made from Lisanne supplies above-average extract attenuation. The moderate cytolysis harmonizes with balanced proteolysis, resulting in good malt qualities regardless of germination techniques. Lisanne supplies good extract with average final attenuation. The wort viscosity is assessed as good.

Agronomic properties

The head retention of beer brewed from Lisanne is above average. The tasting results lie within the average of the compared brews and display no peaks or outliers in individual evaluation criteria. We note the weakness in final attenuation demonstrated in practical tests.

Malt quality

Processing malt from Lisanne is unproblematic in every respect and results in very high yield rates. The favourable nitrogen composition ensures high wort quality. Lauter time and clouding are assessed as very good.

Processing parameters

Process parameters

- Screening >2.5 mm
- Hl weight
- Thousand grain weight
- Market yield
- Grain yield
- Rhynchosporium
- Net blotch
- Mildew
- Head breakage
- Stem breakage
- Lodging resistance
- Height of growth
- Plant density
- Time of ear emerging
- Root density
- Height of plant
- Lodging resistance
- Heading date
- Heading height
- Milling
- Malt protein
- Grain yield
- Thousand grain weight
- Hl weight
- Screening >2.5 mm

Scale

+++ = very good, very high, very early, very short
--- = very poor, very low, very late, very long

Source: LfL, IPZ 2b, BSA, Beschreibende Sortenliste 2006

### Head morphology

- Glaucosity: medium to strong
- Attitude: semi-erect
- Rows: two-rowed
- Density: medium
- Length: medium

### Kernel morphology

- Pubescence of the rachilla: long
- Husk: present
- Anthocyanin colouration of the lemma nerves: medium to strong
- Spiculation of the inner dorsal lemma nerves: none or very little
- Pubescence of the ventral furrow: none
- Colour of the aleurone layer: whitish

### Head retention

The head retention of beer brewed from Lisanne is above average. The tasting results lie within the average of the compared brews and display no peaks or outliers in individual evaluation criteria. We note the weakness in final attenuation demonstrated in practical tests.
The variety Lisanne, classified with a medium time of ear emerging, is distinguished by a high thousand-grain weight and by very high plant density. Both of these properties together guarantee consistently high yields. Good resistance, in particular to mildew and Ramularia, combined with low protein content make it a malting barley suited for all locations and climate zones.

Brewing malt made from Lisanne supplies above-average extract attenuation. The moderate cytolysis harmonizes with balanced proteolysis, resulting in good malt qualities regardless of germination techniques. Lisanne supplies good extract with average final attenuation. The wort viscosity is assessed as good.

### Agronomic properties

<table>
<thead>
<tr>
<th>Time of ear emerging</th>
<th>Plant density</th>
<th>Lodging resistance</th>
<th>Height of plants</th>
<th>Stem breakage</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Rhythm of growth</th>
<th>Path of lodging</th>
<th>Height of plants</th>
<th>Stem breakage</th>
</tr>
</thead>
</table>

### Malt quality

Processing malt from Lisanne is unproblematic in every respect and results in very high yield rates. The favourable nitrogen composition ensures high wort quality. Lauter time and clouding are assessed as very good.

### Processing parameters

Processing malt from Lisanne is unproblematic in every respect and results in very high yield rates. The favourable nitrogen composition ensures high wort quality. Lauter time and clouding are assessed as very good.

### Head retention

The head retention of beer brewed from Lisanne is above average. The tasting results lie within the average of the compared brews and display no peaks or outliers in individual evaluation criteria. We note the weakness in final attenuation demonstrated in practical tests.

---

**Source:** LfL, IPZ 2b, BSA, Beschreibende Sortenliste 2006

+++ = very good, very high, very early, very short; --- = very poor, very low, very late, very long
**Marthe**

**Breeder:** Nordsaat Saatzucht GmbH

**Origin:** Neruda x Recept

**Bundessortenamt number:** GS 2125

**Year of approval:** 2005

**Agronomic properties:**
- Medium maturity, good stem stability, medium susceptibility to disease, high yield.

**Wort quality:**
- Outstanding yield. Good nitrogen supply and viscosity.

**Barley quality:**
- Large kernels. No propensity to sprouting.

**Beer quality:**
- Average tasting results. Average head retention and stability.

**Malt quality:**
- Good to very good extract with high final attenuation. Balanced proportion of cytolysis to proteolysis. Stable results in various malting methods. Short malting process results in somewhat higher beta-glucan.

**Beer quality**

**Weighted quality summary**

- **Bitterness:**
  - **Marthe:** 4.3
  - **Pasadena:** 4.2

- **Freshness:**
  - **Marthe:** 4.2
  - **Pasadena:** 4.1

- **Full bodiness:**
  - **Marthe:** 4.0
  - **Pasadena:** 3.9

- **Tasting:**
  - **Marthe:** 4.3
  - **Pasadena:** 4.1

- **Trunk:**
  - **Marthe:** 4.2
  - **Pasadena:** 4.1

- **Odour:**
  - **Marthe:** 4.0
  - **Pasadena:** 4.1
Marthe

**Breeder:** Nordsaat Saatzucht GmbH

**Origin:** Neruda x Recept

**Bundessortenamt number:** GS 2125

**Year of approval:** 2005

**Agronomic properties:**
Medium maturity, good stem stability, medium susceptibility to disease, high yield.

**Wort quality:**
Outstanding yield. Good nitrogen supply and viscosity.

**Barley quality:**
Large kernels. No propensity to sprouting.

**Beer quality:**
Average tasting results. Average head retention and stability.

**Malt quality:**
Good to very good extract with high final attenuation. Balanced proportion of cytolysis to proteolysis. Stable results in various malting methods. Short malting process results in somewhat higher beta-glucan.
Agronomic properties

The very adaptable variety Marthe is thoroughly suitable for all soils and climate regions. According to the breeder, the sowing time tolerance is from early March to late April. Marthe is distinguished by medium maturity, good stem stability, medium susceptibility to disease and high yields. The large kernels, which display no propensity to sprouting, positively round off the barley quality.

<table>
<thead>
<tr>
<th>Scale</th>
<th>Time of ear emerging</th>
<th>Plant density</th>
<th>Height of growth</th>
<th>Anthocyanin colouration</th>
<th>Pubescence of the ventral furrow</th>
<th>Colour of the aleurone layer</th>
<th>kolbach Index</th>
<th>Lösungsgrad</th>
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<td>whitish</td>
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Brewing malt made from Marthe supplies good to very good extract with high final attenuation. A balanced proportion of cytolysis and proteolysis results in stable results from various malting methods. Somewhat higher beta-glucan levels are observed after shorter malting. In spite of the high extract content, Marthe leans towards higher protein levels.

Processing malt from Marthe is unproblematic in every respect and delivers very good yields. A good nitrogen supply and low viscosity ensure high wort quality with average lauter times and clouding levels.

The head retention of beer brewed from Marthe lies within the average of the reference brews made from established malting barley varieties. The tasting results also lie within the average of the compared brews and display no peaks or outliers in individual evaluation criteria.
Agronomic properties

The very adaptable variety Marthe is thoroughly suitable for all soils and climate regions. According to the breeder, the sowing time tolerance is from early March to late April. Marthe is distinguished by medium maturity, good stem stability, medium susceptibility to disease and high yields. The large kernels, which display no propensity to sprouting, positively round off the barley quality.

Malt quality

Brewing malt made from Marthe supplies good to very good extract with high final attenuation. A balanced proportion of cytolysis and proteolysis results in stable results from various malting methods. Somewhat higher beta-glucan levels are observed after shorter malting. In spite of the high extract content, Marthe leans towards higher protein levels.

Processing parameters

Processing malt from Marthe is unproblematic in every respect and delivers very good yields. A good nitrogen supply and low viscosity ensure high wort quality with average lauter times and clouding levels.

Head retention

The head retention of beer brewed from Marthe lies within the average of the reference brews made from established malting barley varieties. The tasting results also lie within the average of the compared brews and display no peaks or outliers in individual evaluation criteria.
Pasadena

**Breeder:** Lochow-Petkus GmbH

**Origin:** Marina x Krona

**Bundessortenamt number:** GS 1672

**Year of approval:** 1998

---

**Agronomic properties:**
Medium to late maturity, very good stem stability and balanced agronomic properties. Low to very low protein content, high yield. Medium susceptibility to diseases.

**Wort quality:**
Medium yield, good nitrogen content, low viscosity in spite of somewhat higher beta-glucan values.

**Beer quality:**
Medium average tasting results, good head retention and below-average stability.

**Barley quality:**
Medium kernel size, low propensity to sprouting.

**Malt quality:**
Pasadena

Breeder: Lochow-Petkus GmbH
Origin: Marina x Krona
Bundessortenamt number: GS 1672
Year of approval: 1998

Agronomic properties:
Medium to late maturity, very good stem stability and balanced agronomic properties. Low to very low protein content, high yield. Medium susceptibility to diseases.

Barley quality:
Medium kernel size, low propensity to sprouting.

Malt quality:

Wort quality:
Medium yield, good nitrogen content, low viscosity in spite of somewhat higher beta-glucan values.

Beer quality:
 Medium average tasting results, good head retention and below-average stability.

Beer quality summary:
- Bitterness: 4.4
- Freshness: 4.2
- Flavour: 4.0
- Odour: 3.8
- Full bodiness: 3.6

Data for one year

Weighted quality:
- Bitterness: 3.8
- Freshness: 3.6
- Flavour: 4.0
- Odour: 4.2
- Full bodiness: 4.4
The medium to late-maturing malting barley variety Pasadena has very balanced agronomic properties. On medium soil locations, it has medium to high yields with high plant density. The tendency to very low protein accumulation results in high extract content. Its high stem stability gives Pasadena good marks in stem breakage and in resistance against lodging. Its susceptibility to rhynchosporium gives it medium susceptibility to disease with otherwise very good resistance properties.

Brewing malt made from Pasadena provides high extract paired with high final attenuation. Its pronounced proteolysis and average cytolysis ensure good extract yield with equally average alpha-amylase activity and Diastatic power. In spite of good viscosity levels, somewhat higher beta-glucan levels are observed after shorter malting.

Processing malt from Pasadena is good and results in average yields. Pasadena has served for many years as the comparative variety for testing within the state variety trials and the Berliner Programm. The worts display good lautering behaviour and distinguish a good nitrogen supply and low viscosity and clouding.

### Head morphology
- **Glaucosity**: medium to strong
- **Attitude**: semi-erect
- **Rows**: two-rowed
- **Density**: medium
- **Length**: medium

### Kernel morphology
- **Pubescence of the rachilla**: long
- **Husk**: present
- **Anthocyanin colouration of the lemma nerves**: medium to strong
- **Spiculation of the inner dorsal lemma nerves**: none or very little
- **Pubescence of the ventral furrow**: none
- **Colour of the aleurone layer**: whitish

### Malt quality
- **Extract**:
  - Pasadena: 90
  - Scarlett (100%): 95
- **Final attenuation**:
  - Pasadena: 5
  - Scarlett (100%): 4.5
- **Wort colour**:
  - Pasadena: 90
  - Scarlett (100%): 95
- **Kolbach Index**:
  - Pasadena: 100
  - Scarlett (100%): 105
- **Protein**:
  - Pasadena: 90
  - Scarlett (100%): 95
- **Viscosity**:
  - Pasadena: 3
  - Scarlett (100%): 2.5
- **Friabilimeter**:
  - Pasadena: 5
  - Scarlett (100%): 4.5
- **Extract**:
  - Pasadena: 90
  - Scarlett (100%): 95

The head retention of beer brewed from Pasadena lies within the average of the reference brews made with other malting barley varieties. The tasting results are also within the average of the reference brews and display no peaks or outliers in individual evaluation criteria. The beers have very good values in expected permanent haze with varying good assessment in the force test.

### Data for one year
- **Final attenuation**:
  - Pasadena: 5
  - Scarlett (100%): 4.5
- **Wort colour**:
  - Pasadena: 90
  - Scarlett (100%): 95
- **Kolbach Index**:
  - Pasadena: 100
  - Scarlett (100%): 105
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  - Pasadena: 90
  - Scarlett (100%): 95
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  - Pasadena: 90
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### Processing parameters
- **Extract**
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- **Final attenuation**
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Brewing malt made from Pasadena provides high extract paired with high final attenuation. Its pronounced proteolysis and average cytolysis ensure good extract yield with equally average alpha-amylase activity and Diastatic power. In spite of good viscosity levels, somewhat higher beta-glucan levels are observed after shorter malting.

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The head retention of beer brewed from Pasadena lies within the average of the reference brews made with other malting barley varieties. The tasting results are also within the average of the reference brews and display no peaks or outliers in individual evaluation criteria. The beers have very good values in expected permanent haze with varying good assessment in the force test.
Power

**Breeder:** Saatzuchtgesellschaft Streng’s Erben

**Origin:** Saloon x (Colada x (Lux x Annabell))

**Bundessortenamt number:** GS 2136

**Year of approval:** 2005

**Agronomic properties:**
Early to medium maturity, medium stem stability, medium susceptibility to disease, high to very high yield.

**Barley quality:**
Smaller kernels, low propensity to sprouting.

**Malt quality:**
Good extract and final attenuation, Balanced proportion of cytolysis and proteolysis. Medium to low alpha amylase and beta amylase. Short malting methods greatly decrease final attenuation and alpha amylase.

**Wort quality:**
Average yield. Good nitrogen supply, somewhat higher viscosity.

**Beer quality:**
Average tasting results, Very good head stability and average stability.

**Beer quality: Weighted quality summary**

- **Bitterness**
  - Power: 4.2
  - Pasadena: 4.3

- **Freshness**
  - Power: 3.9
  - Pasadena: 3.9

- **Full bodiness**
  - Power: 4.1
  - Pasadena: 4.2

- **Tasting**
  - Power: 4.0
  - Pasadena: 4.0

- **Odour**
  - Power: 4.3
  - Pasadena: 4.3

**Pasadena Power**

Daten einjährig gewichtete Note

**Bittere**

- Power: 4.0
- Pasadena: 4.1

**Rezenz**

- Power: 4.2
- Pasadena: 4.3

**Vollmundigkeit**

- Power: 3.9
- Pasadena: 3.9

**Trunk**

- Power: 4.1
- Pasadena: 4.2

**Geruch**

- Power: 4.0
- Pasadena: 4.0

- Power: 4.3
- Pasadena: 4.3
Power

**Breeder:** Saatzuchtgesellschaft Streng’s Erben

**Origin:** Saloon x (Colada x (Lux x Annabell))

**Bundessortenamt number:** GS 2136

**Year of approval:** 2005

**Agronomic properties:**
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**Barley quality:**
- Smaller kernels, low propensity to sprouting.

**Malt quality:**

**Wort quality:**
- Average yield. Good nitrogen supply, somewhat higher viscosity.

**Beer quality:**
- Average tasting results. Very good head stability and average stability.

---

**Weighted quality summary**

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<tr>
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</tr>
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**Daten einjährig gewichtete Note**

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<td></td>
</tr>
<tr>
<td><strong>Geruch</strong></td>
<td>4.0</td>
<td>3.9</td>
</tr>
</tbody>
</table>
**Agronomic properties**

Depending on the crop region, the variety Power excels with above-average yield results, which are realized primarily through its broad spectrum of resistances. Power is distinguished by early to medium maturity, medium stem stability, medium susceptibility to disease and high to very high yields. Its tendency to form somewhat smaller kernels has led to below average screening in extreme years.

**Malt quality**

Brewing malt made from Power supplies good extract with high final attenuation. A balanced proportion of cytolysis and proteolysis allows various malting methods to achieve the malt specification. Short malting methods greatly decrease the final attenuation and alpha amylase. The beta-glucan content of the 65°C mash is far lower than average.

**Processing parameters**

Processing malt from Power is unproblematic in every respect and results in average yield rates. With an average lauter time, the viscosity is somewhat increased and clouding levels good. The good nitrogen supply has a positive effect on the wort quality.

**Head retention**

The head retention of beer brewed from Power is above average to the reference brews using other malting barley varieties. The stability levels and the tasting results lie within the average of the compared brews and display no peaks or outliers in individual evaluation criteria.

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**Power**

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**Data for one year**

- Lauter time: 6.3
- EBC: 5.2
- Clouding: 77.9
- Brewery yield: 77.3

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**Scarlett**

- Lauter time: 7.5
- EBC: 6.0
- Clouding: 77.0
- Brewery yield: 77.0

---

**Pasadena (100 %)**

- Lauter time: 8.5
- EBC: 7.0
- Clouding: 77.5
- Brewery yield: 77.5

---

**Head morphology**

- Glaucosity: semi-nodding
- Altitude: medium
- Rows: semi-nodding
- Density: medium
- Length: medium

**Kernel morphology**

- Pubescence of the rachilla: long
- Husk: present
- Anthocyanin colouration of the lemma nerves: medium
- Spiculation of the inner dorsal lemma nerves: none or very little
- Pubescence of the ventral furrow: none or very little
- Colour of the aleurone layer: whitish

---

**Scale**

+++ = very good, very high, very early, very short; --- = very poor, very low, very late, very long

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**Source:** LfL, IPZ 2b, BSA, Beschreibende Sortenliste 2006
Agronomic properties

Depending on the crop region, the variety Power excels with above-average yield results, which are realized primarily through its broad spectrum of resistances. Power is distinguished by early to medium maturity, medium stem stability, medium susceptibility to disease and high to very high yields. Its tendency to form somewhat smaller kernels has led to below average screening in extreme years.

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Processing parameters

Processing malt from Power is unproblematic in every respect and results in average yield rates. With an average lauter time, the viscosity is somewhat increased and clouding levels good. The good nitrogen supply has a positive effect on the wort quality.

Head morphology

- Glaucosity: strong
- Attitude: semi-nodding
- Rows: two-rowed
- Density: medium
- Length: medium

Kernel morphology

- Pubescence of the rachilla: long
- Husk: present
- Anthocyanin colouration of the lemma nerves: medium
- Spiculation of the inner dorsal lemma nerves: none or very little
- Pubescence of the ventral furrow: none or very little
- Colour of the aleurone layer: whitish

The head retention of beer brewed from Power is above average to the reference brews using other malthing barley varieties. The stability levels and the tasting results lie within the average of the compared brews and display no peaks or outliers in individual evaluation criteria.
Quench

**Breeder:** Syngenta Seeds

**Origin:** Drum x Sebastian

**Bundessortenamt number:** GS 2194

**Year of approval:** 2006

---

**Beer quality**

- **Odour:**
  - Quench: 4.7
  - Pasadena: 4.3

- **Tasting:**
  - Quench: 4.3
  - Pasadena: 4.1

- **Full bodiness:**
  - Quench: 4.5
  - Pasadena: 4.7

- **Freshness:**
  - Quench: 3.9
  - Pasadena: 4.1

**Agronomic properties:**
- Somewhat later maturity, good stem stability, good disease resistance properties (rhynchosporium), good screening > 2.5 mm (compared with newly approved varieties in 2006)

**Wort quality:**
- Medium extract yield, medium lauter times. Medium nitrogen supply and good viscosity. Low beta-glucan content. Medium to good attenuation.

**Barley quality:**
- Average grading, somewhat lower protein content, latency not observed.

**Malt quality:**
- Good extract attenuation, medium final attenuation. Good cytolysis and proteolysis even with short malt- ing process. Low beta-glucan content. Medium to good beta-amylase activity but low alpha-amylase activity.

**Beer quality**

- **Odour:**
  - Quench: 4.7
  - Pasadena: 4.3

- **Tasting:**
  - Quench: 4.3
  - Pasadena: 4.1

- **Full bodiness:**
  - Quench: 4.5
  - Pasadena: 4.7

- **Freshness:**
  - Quench: 3.9
  - Pasadena: 4.1
Quench

Breeder: Syngenta Seeds
Origin: Drum x Sebastian
Bundessortenamt number: GS 2194
Year of approval: 2006

Wor quality:
Medium extract yield, medium lauter times. Medium nitrogen supply and good viscosity. Low beta-glucan content. Medium to good attenuation.

Beer quality:
Normal tasting results. Average head retention.

Agronomic properties:
Somewhat later maturity, good stem stability, good disease resistance properties (ryhnchosporium), good screening > 2.5 mm (compared with newly approved varieties in 2006)

Barley quality:
Average grading, somewhat lower protein content, latency not observed.

Malt quality:
Good extract attenuation, medium final attenuation. Good cytolysis and proteolysis even with short malthing process. Low beta-glucan content. Medium to good beta-amylase activity but low alpha-amylase activity.
**Agronomic properties**

The variety Quench, which matures somewhat late and is therefore especially suited to early harvest regions, is distinguished in particular by its very good tillering capacity. The resultant high plant density and the good screening properties consistently guarantee very high yields. Quench has low protein levels and excellent resistance, in particular to mildew and rhynchosporium. The time of ear emerging is comparatively late.

Brewing malt made from Quench supplies above-average values for all chief malt properties. Quench delivers good extract and average final attenuation. A balanced ratio of high cytolysis and proteolysis result in stable malt properties even under a variety of malting processes. The low viscosities ensure optimal processing parameters.

**Malt quality**

Processing malt made from Quench is unproblematic in every respect and delivers very good yields. A good nitrogen supply and low viscosity ensure high wort quality. Lauter time and clouding are assessed as very good.

**Processing parameters**

The head retention of beer brewed from Quench lies within the average of the reference brews made with other malting barley varieties. The tasting results are also within the average of the reference brews and display no peaks or outliers in individual evaluation criteria. We note the weakness in final attenuation demonstrated in practical tests.

**Head morphology**

- **Glaucosity**: medium
- **Attitude**: semi-erect to horizontal
- **Rows**: two-rowed
- **Density**: loose
- **Length**: short to medium

**Kernel morphology**

- **Pubescence of the rachilla**: short
- **Husk**: present
- **Anthocyanin colouration of the lemma nerves**: little to medium
- **Spiculation of the inner dorsal lemma nerves**: none to very little
- **Pubescence of the ventral furrow**: none
- **Colour of the aleurone layer**: whitish

**Head retention**

The head retention of beer brewed from Quench lies within the average of the reference brews made with other malting barley varieties. The tasting results are also within the average of the reference brews and display no peaks or outliers in individual evaluation criteria. We note the weakness in final attenuation demonstrated in practical tests.
The variety Quench, which matures somewhat late and is therefore especially suited to early harvest regions, is distinguished in particular by its very good tillering capacity. The resultant high plant density and the good screening properties consistently guarantee very high yields. Quench has low protein levels and excellent resistance, in particular to mildew and rhychosporium. The time of ear emerging is comparatively late.

Malt quality

Brewing malt made from Quench supplies above-average values for all chief malt properties. Quench delivers good extract and average final attenuation. A balanced ratio of high cytolysis and proteolysis result in stable malt properties even under a variety of malting processes. The low viscosities ensure optimal processing parameters.

Processing malt made from Quench is unproblematic in every respect and delivers very good yields. A good nitrogen supply and low viscosity ensure high Wort quality. Lauter time and clouding are assessed as very good.

The head retention of beer brewed from Quench lies within the average of the reference brews made with other malting barley varieties. The tasting results are also within the average of the reference brews and display no peaks or outliers in individual evaluation criteria. We note the weakness in final attenuation demonstrated in practical tests.
Scarlett

**Breeder:** Saatzucht Josef Breun GbR

**Origin:** Amazone x Br. St.2736e x Kym

**Bundessortenamt number:** GS 1543

**Year of approval:** 1995

---

**Agronomic properties:**
- Early maturity
- Good lodging resistance and stem stability
- Medium susceptibility to diseases with location-specific mildew and NBV susceptibility
- Average yield with good percentages of screening above 2.5 mm.

**Barley quality:**
- Medium to large kernels
- Low propensity to sprouting

**Malt quality:**
- Very high extract with average, medium final attenuation
- Outstanding processing capabilities due to good cytolysis with medium proteolysis
- Very good alpha-amylase activity as well as very high Diastatic Power

**Wort quality:**
- Very good yield, good nitrogen level in wort
- Medium viscosity, low beta-glucan content

**Beer quality:**
- Good tasting results within the average of the comparative varieties
- Medium to good head retention

---

**Weighted quality summary:**
- Bitterness: 3.5
- Freshness: 3.0
- Bodiness: 4.0
- Flavour: 4.5
- Odour: 3.5

**Data for one year**

**Scarlett**

**Beer quality**

- Odour
- Flavour
- Bodiness
- Freshness

---

**Beer quality**

**Scarlett**

**Beer quality**

**Alexis**

**Beer quality**

---

**Weighted quality summary**

- Bitterness: 3.5
- Freshness: 3.0
- Bodiness: 4.0
- Flavour: 4.5
- Odour: 3.5
Scarlett

Breeder: Saatzucht Josef Breun GdB
Origin: Amazone x Br. St.2760 x Kym
Bundessortenamt number: GS 1543
Year of approval: 1995

Beer quality

Agronomic properties:
Early maturity, good lodging resistance and stem stability, medium susceptibility to diseases with location-specific mildew and NBV susceptibility. Average yield with good percentages of screening above 2.5 mm.

Barley quality:
Medium to large kernels, low propensity to sprouting.

Malt quality:
Very high extract with average, medium final attenuation. Outstanding processing capabilities due to good cytolysis with medium proteolysis. Very good alpha-amylase activity as well as very high Diastatic Power.

Wort quality:
Very good yield, good nitrogen level in wort. Medium viscosity, low beta-glucan content.

Beer quality:
Good tasting results within the average of the comparative varieties. Medium to good head retention.
The very adaptable variety Scarlett is thoroughly suitable for all soils and climate regions. It matures early and has good lodging resistance. Scarlett is distinguished by medium susceptibility to disease. Its susceptibility to mildew and non-parasitic leaf browning is high and varies depending on the location and can have a negative effect on the otherwise high yields.

Brewing malt made from Scarlett supplies very good extract with average final attenuation. Strong cytolysis and balanced proteolysis deliver stable results using various malting methods. With its very good alpha-amylase activity and higher than average Diastatic power, Scarlett results in very lovely, pale malts of medium viscosity.

Processing malt from Scarlett is unproblematic in every respect and delivers excellent yields. Its outstanding ability to process high-quality worts with good lautering times and optimal clouding levels has made Scarlett the dominant malting barley variety in Germany for a long time. Today it still is used by many processors as the reference variety.

The head retention of beer brewed from Scarlett lies just within the average of the reference brews made with other malting barley varieties. The tasting results also lie within the average of the compared brews and display a drop only in assessment of the odour.
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### Agronomic properties

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### Malt quality

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### Processing parameters

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The head retention of beer brewed from Scarlett lies just within the average of the reference brews made with other malting barley varieties. The tasting results also lie within the average of the compared brews and display a drop only in assessment of the odour.

### Head morphology

- **Glauosity:** strong
- **Attitude:** semi-erect
- **Rows:** two-rowed
- **Density:** lax to medium
- **Length:** medium

### Kernel morphology

- **Pubescence of the rachilla:** long
- **Husk:** present
- **Anthocyanin colouration of the lemma nerves:** strong
- **Spiculation of the inner dorsal lemma nerves:** none or very little
- **Pubescence of the ventral furrow:** none
- **Colour of the aleurone layer:** whitish

### Head 

The head retention of beer brewed from Scarlett lies just within the average of the reference brews made with other malting barley varieties. The tasting results also lie within the average of the compared brews and display a drop only in assessment of the odour.
Worldwide, Germany enjoys high esteem as one of the leading nations in the production and sales of excellent brewers malt. Centuries-old tradition and generations of handed-down experience in malting are the foundations.

Brewers malt, usually made from malting barley or wheat, provides full flavour and its characteristic colour to the beer. According to the German Reinheitsgebot (purity law), bottom-fermented beers such as light or dark Lager, Export or Pils may only be brewed from barley malt. Two-rowed spring barley is a specialized crop, cultivated solely for malting. The guaranteed supply of high-quality malting barley is the foundation for the production of high-quality malt specialities.

The German malt industry is dominated by medium-sized enterprises, but its structure differs greatly from region to region. For example, approximately two thirds of the German maltsters are located in Bavaria and Baden Württemberg. Most of the larger enterprises with a high export share chiefly are situated on the major German water routes of the Rhine, Main, Danube and Elbe, ensuring cost-effective exports of larger amounts of malt via seaports to the entire world.

In addition to the prevalent malt varieties like Pilsner, Caramel and Munich malt, the maltsters produce speciality malts needed for the manufacture of Germany’s unique beer diversity. Wheat malt, sour malt, rye, spelt and roasted malt form part of the portfolio of many malt producers.

Since the different malting varieties described in this Malting Barley Variety Portfolio need to be malted differently to attain the malt specifications required by the brewery, precise knowledge of the processability and the variety-specific processing properties are exceedingly important. Even the origins of the varieties play a certain role in their processing.

For reasons of supply security, but also based on quality considerations, Germany’s maltsters primarily process domestic malting barley, which have passed the value analyses procedure of Bundessortenamt, the brewing test of Berliner Programm and finally have been recommended for cultivation by the state promotional associations.

The Malting Process

The aim of the malting process is to form or activate enzymes, which ultimately solubilise the starch contained in the grain and convert it into a soluble form called maltose or malt sugar, which can be picked up by the yeast. The first step in malting is to steep the grain. During the 1-2 day long steeping process, the grain is immersed in water a number of times according to its vitality. These steeping phases serve water absorption and to clean the grain. After a few hours, the grain begins to germinate and this process is continued over another 4-5 days after the steeped grain is conveyed to the germination vessels. The germination process is steered individually and according to the desired malt variety via the parameters of temperature and humidity. The grain is then called „green malt.”

The germination process is halted by careful kiln drying of the green malt. The temperatures used during drying and the selected curing temperature influence the flavour and the colour of the malt and hence that of the later beer. Low curing final temperatures (approx. 80°C) result in light malt (Pilsner type), high curing temperatures (90-110°C) produce dark malt colours (Munich and Vienna types and various caramel malts).
# Malt types

<table>
<thead>
<tr>
<th>Malt type</th>
<th>Colour / EBC</th>
<th>Use</th>
<th>Amount</th>
<th>Purpose of use</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pilsner malt</td>
<td>3 - 5</td>
<td>• Pilsner beers • Every other beer type</td>
<td>100 %</td>
<td>• For the production of all pale beers • As base malt for speciality beers</td>
</tr>
<tr>
<td>Vienna malt</td>
<td>7 – 9</td>
<td>• Export beers • Märzenbier • Festival beers • Home-brewed beers</td>
<td>100 %</td>
<td>• To achieve “amber coloured beers” and promote full-bodied flavour</td>
</tr>
<tr>
<td>Munich malt</td>
<td>I 12 – 17</td>
<td>• Dark beers • Festival beers • Stouts • Malt beers • Black beers</td>
<td>up to 100 %</td>
<td>• Underscores the typical beer character through intensified flavour • Achieves intense beer colour</td>
</tr>
<tr>
<td></td>
<td>II 20 – 25</td>
<td>•</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Spitz malt</td>
<td>2.5 – 4.5</td>
<td>• To compensate for highly soluble brewing malts</td>
<td>max. 15 – 20 %</td>
<td>• Improved head retention</td>
</tr>
<tr>
<td>Smoked malt</td>
<td>3 – 6</td>
<td>• Smoked beers • Lagers • Kellerbier • Speciality beers, e.g. for tavern breweries • Wheat beers</td>
<td>up to 100 %</td>
<td>• Achieves the typical smoked flavour</td>
</tr>
<tr>
<td>Sour malt</td>
<td>pH 3.4 – 3.6</td>
<td>• Pilsner beers • Light beers • Draught beers</td>
<td>up to 5 %</td>
<td>• Lowers the wort pH, thereby • Improves mashing performance • Intensifies fermentation • Effects pale beer colours in Pilsner beers • Improves flavour stability • Fuller beer colour • Adjusts beer colour in Pilsner or Lager beers • Flavour optimization for yeast wheat beers</td>
</tr>
<tr>
<td>Melanoidin malt</td>
<td>60 – 80</td>
<td>• Wheat beers • Bocks • Dark beers • Red ales • Amber beers</td>
<td>up to 20 %</td>
<td>• Improves flavour stability and full-bodied flavour • Balances beer colour • Achieves reddish colour</td>
</tr>
<tr>
<td>Caramel malt light</td>
<td>20 – 30</td>
<td>• Pale beers • Export beers • Festival beers • Low alcohol malt beers (Nährbier) • Wheat beers • Draught beers • Light beers • Reduced-alcohol beers • Alcohol-free beers</td>
<td>10 – 15 %</td>
<td>• Increases full-bodied flavour • Intensifies malt flavour • Improved head retention • Full, balanced flavour • Fuller beer colour • Adjusts beer colour in Pilsner or Lager beers • Flavour optimization for yeast wheat beers</td>
</tr>
<tr>
<td>Caramel malt dark</td>
<td>60 – 160</td>
<td>• Bock beers • Dark beers • Red ale • Amber beers • Festival beers • Non alcohol malt beers • Low alcohol malt beers • Light beers</td>
<td>up to 20 %</td>
<td>• Improves flavour stability and full-bodied flavour • Balances beer colour • Optimizes mash work • Intensifies malt flavour</td>
</tr>
<tr>
<td>Roasted malt</td>
<td>800 – 1500</td>
<td>• Dark beers • Stouts • Alt beers • Bocks • Black beers</td>
<td>1 – 5 %</td>
<td>• Intensifies the typical flavour of dark beers and beer colour</td>
</tr>
<tr>
<td>Diastatic barley malt</td>
<td>3 – 6</td>
<td>All beer varieties</td>
<td>as needed</td>
<td>• High enzyme capacity, improves processing, optimizes solubility and breakdown of starch • Production of malt extracts</td>
</tr>
</tbody>
</table>

The list is merely an excerpt of the types of malt available. In the area of wheat and speciality malts in particular, German maltsters offer a broad spectrum of different products. Detailed information can be obtained directly from the maltsters or from the Deutsche Mälzerbund e.V.
Brewers malt from Germany enjoys high esteem worldwide. Extensive quality assurance in the entire chain of production from the farm to malt delivery makes it a safe foodstuff. Numerous external and internal measures are involved and interlocked for quality assurance of the raw material.

In farming of malting barley, only very small quantities of fertilizers and pesticides are used. The risk of detecting contaminants is extremely low and the environment is spared.

An internal industry monitoring system was introduced in Germany to check for and safeguard from pollutants in malting barley. Alongside this, the maltsters operate internal comprehensive systematic controls of the raw materials and all stages of production. Quality assurance systems according to standards such as ISO 9001, GMP+, Q&S, IFIS or HACCP have been introduced and certified.

1. External quality assurance

Since 2005, the German Maltsters Association (Deutscher Mälzerbund) has organized an extensive pollutant monitoring system for malting cereals. This keeps the status of contaminants under surveillance all over the country and documents the responsibility of the processing sector in all enterprises. The required analyses are carried out by an internationally renowned analyst institute according to uniform criteria using validated established methods.

In the scope of the monitoring system, the product-specific risks of selected pesticides, heavy metals and mycotoxins is checked. Additionally, aflatoxins and microbiological test organisms are monitored. The testing spectrum and the composition of the monitoring package is reviewed at regular intervals by the partners and – if needed – supplemented or modified.

The data collected by the monitoring system are statistically assessed by the neutral institute and annually made available to all system participants. Because of the perennial statistical evaluation, the system is excellently suited to monitor food safety and recognize acute risks as quickly as possible.

Moreover, the participating maltsters receive a certificate from the neutral institute documenting product safety to supplement their internal quality management systems and control measures.
2. Quality assurance in production and storage

In keeping with the principle of supply chain responsibility, German maltsters use audits of the collectors and suppliers silos to ensure proper work of their raw materials suppliers. Only appropriate operation methods can prevent quality losses and the formation of contaminants during storage. For this, the storekeepers must be well trained and sufficiently experienced. The condition of the supplier silos and the working methods of the storekeepers are checked with regular audits.

Before malting barley is accepted by a malt house for processing, the maltsters demand representative samples of the batch being delivered from their suppliers. If the goods comply with the qualitative parameters and the food safety regulations, they can be delivered to the maltster. Incoming goods inspection is carried out according to the criteria set down in the quality assurance systems of the maltster.

In addition to modern analytic devices such as near-infrared spectrometers and protein electrophoresis, manual evaluation is an important tool of intake analysis. Grain anomalies, mould or improper storage conditions can be recognized by these quickly and reliably.

One of the key criteria for the quality of brewing grain is its health and therefore the ability for germination (germination energy), which can be affected by improper storage. Thorough controls are carried out by employing germination tests in the enterprise laboratories.

During inspections, the previous freight and the cleanliness of the delivery vehicles are also checked in order to exclude possible contamination by undesired substances during transport.

The maltster is able to quickly trace the origins of the goods via retained samples from the delivery and charge documentation in storage and processing.
Quality assurance for malting barley

<table>
<thead>
<tr>
<th>PHASE</th>
<th>ACTIVITY</th>
<th>OBJECTIVE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Variety selection</td>
<td>Cultivation field control</td>
<td>Resistance</td>
</tr>
<tr>
<td>Variety recommendation</td>
<td>Variety recommendation</td>
<td>Yields</td>
</tr>
<tr>
<td></td>
<td>Berliner Programm</td>
<td>Malt quality</td>
</tr>
<tr>
<td></td>
<td>Regional variety tests</td>
<td>Brewing quality</td>
</tr>
<tr>
<td></td>
<td>Breeder programmes</td>
<td></td>
</tr>
<tr>
<td>Sowing</td>
<td>Weather observation</td>
<td>Reduce DON formation</td>
</tr>
<tr>
<td></td>
<td>Avoidance of maize as previous crop</td>
<td>Prevent gushing risk</td>
</tr>
<tr>
<td></td>
<td>Certified seed</td>
<td></td>
</tr>
<tr>
<td>Growth</td>
<td>Weather observation</td>
<td>Mycotoxin risk assessment</td>
</tr>
<tr>
<td></td>
<td>Plant development observation</td>
<td>Appraisal of fusarium infestation</td>
</tr>
<tr>
<td></td>
<td>Plant protection advice</td>
<td>Appraisal of DON formation</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Prevent gushing risk</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Plant health</td>
</tr>
<tr>
<td>Harvest</td>
<td>Weather observation</td>
<td>Fusarium risk classification</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Vitality risk appraisal</td>
</tr>
<tr>
<td>Collection</td>
<td>Intake analysis</td>
<td>Minimize risk of vitality loss</td>
</tr>
<tr>
<td></td>
<td>Separation of wet batches</td>
<td>Ensure variety purity</td>
</tr>
<tr>
<td></td>
<td>Pure Variety storage</td>
<td>Homogeneous quality</td>
</tr>
<tr>
<td>Collector storage</td>
<td>Auditing of storage enterprises according to JOSUA Scheme</td>
<td>Minimize risk of mycotoxin formation and vitality loss</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Ensure food safety</td>
</tr>
<tr>
<td>Transport</td>
<td>Previous transport monitoring</td>
<td>Minimize risk of contamination and damage during transport</td>
</tr>
<tr>
<td></td>
<td>Transport declarations</td>
<td></td>
</tr>
<tr>
<td>Receiving</td>
<td>Intake analysis</td>
<td>Determine moisture, protein, grading, odour, appearance, germination ability, germination energy</td>
</tr>
<tr>
<td>Maltster storage</td>
<td>Temperature monitoring</td>
<td>Maintain germination energy</td>
</tr>
<tr>
<td></td>
<td>Ventilation/cooling</td>
<td>Prevent formation of mycotoxins</td>
</tr>
<tr>
<td></td>
<td>Drying</td>
<td>Identify impacts</td>
</tr>
<tr>
<td></td>
<td>Monitoring analyses</td>
<td></td>
</tr>
</tbody>
</table>
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