

# Sensory Analysis of Malt

By J.P. Murray, S.J.E. Bennett, G.S. Chandra, N.I. Davies, and J.L. Pickles

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## ABSTRACT

In the pursuit of quality control, product benchmarking and brand development, the quality of all raw materials used in brewing and their impact on final product flavor is becoming increasingly important. Simple sensory evaluation of raw materials gives an immediate indication of quality and/or the presence of any flavor taints. At present, the analysis of malt by sensory techniques is not a universal requirement. At Brewing Research International (BRI) a method of tasting has been developed and implemented for a wide range of malt types. Data generated by sensory profiling provides information regarding sample quality and the balance of flavors present; in other words, it generates a "fingerprint" for each malt type in terms of aroma and taste characteristics. Such methodology has been successfully adopted for monitoring the effects of specific malting regimes on malt flavor. It has also proved very successful in the identification or "problem" malts or those which exhibit taints, which may otherwise have added negative attributes to the flavor aspect of the finished product. A real potential exists for using this type of technique for determining the malting regimes required to achieve desired flavors, and for the prediction of flavor characteristics in the finished product.

Keywords: sensory, analysis, malt, flavors, beer

## SINTESIS

En la búsqueda de control de calidad, identificación de producto y desarrollo de marca, la calidad de todas las materias primas usadas en hacer cerveza y su impacto en el sabor del producto final se vuelven cada vez más importantes. Una evaluación sensorial de las materias primas dan una indicación inmediata y/o la presencia de cualquier mancha de sabor. Actualmente, el análisis de malta por técnicas sensoriales no es universalmente requerida. En Brewing Research International se ha desarrollado e implementado un método de degustación para un amplio rango de tipos de malta. La información generada al hacer perfiles de degustación proveen información referente a la calidad de la muestra y el balance de los sabores presentes; en otras palabras genera una "huella digital" para cada tipo de malta en términos de aroma y características de sabor. Esta metodología ha sido exitosamente adoptada para monitorear los efectos de regímenes específicos de malteo en el sabor de la malta. También a comprobado ser muy exitoso en la identificación de maltas "problema" o de aquellas que exhiben manchas, que pueden de alguna manera haber adicionado atributos negativos al aspecto de sabor del producto final. Un real potencial existe para usar este tipo de técnica para determinar los regímenes de malteo requerido para lograr los sabores deseados, y para la predicción de características de sabor en el producto final.

## INTRODUCTION

As our knowledge of malt increases and its impact on beer quality is more fully understood, brewers have been able to impose upon their suppliers more and more stringent standards.

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*James Murray has enjoyed a broad-based career in the brewing industry having worked for some of the most prominent international companies. This work has offered a variety of roles and experiences. As Director, R&D at South African Breweries in the 70s, the main objective was the development of a new cost-effective brewing process. With Grand Metropolitan (now Diageo) his main challenge as Technical Director was new brand development. On joining Fosters Group operations in Europe in 1990 as GM-Integration and Engineering, he played a part in rationalizing operations.*

*Currently, he is Associate Director, Brewing Research International where he is a part time consultant advising BRI's international membership on malting and brewing, brands management, sensory technology and its application to the market place among other topics. Dr. Murray is a Fellow of the IOB. He has been a member of the MBAA Technical Committee for the past twenty years.*

*Dr. Murray can be reached by phone: +44(0) 1737 824 232 or Fax: +44(0) 1737 823 653 or e-mail: j.murray@brewingresearch.co.uk*

These demands have primarily focused upon assuring food safety standards, increases in brewing process efficiency and, of course, improvements in product quality. The international malting industry has not been slow to respond to these demands. Malt quality has improved steadily over the last twenty years.

Brewing Research International has been active in all prominent areas of malting technology for a number of years. Not only have we offered a full service to brewers on food safety analyses, but we have been actively engaged in studying the effect of malt on the brewing process and its relationship to beer brand quality.

Brewers generally reflect their own view of malt quality by setting specifications which they believe protect the integrity of their brands - both in quality and economic terms. However, in its conventional form the "malt spec" is by no means as fail-safe as many brewers would admit. BRI has addressed some of the more problematic areas in an attempt to provide more protection to brewers. This activity has resulted in the development of a number of simple test procedures which are now available to our members. These tests are done in conjunction with malt analyses to give a more realistic prediction of what the brewer might

expect. Table I contains a summary of this work. As can be noted, a substantial part of this work is directed at beer quality. The development of the 'malt taste profile' forms an important part of it.

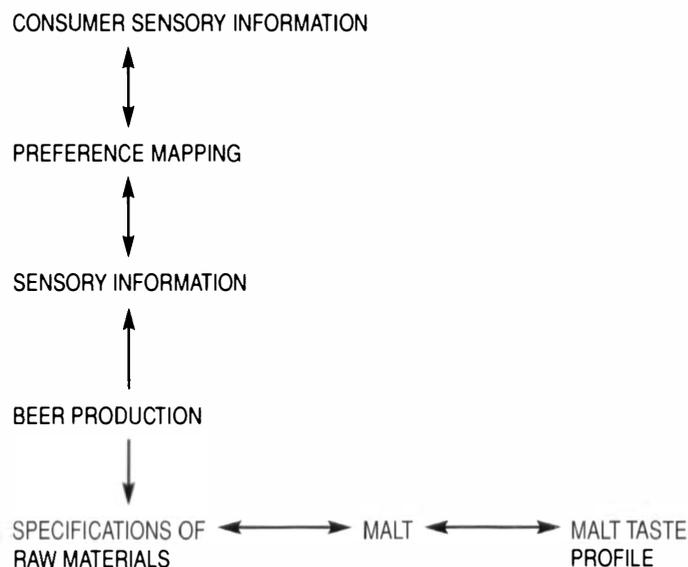
**TABLE I**  
Sensory Analysis of Malt  
Malt Specifications - BRI Areas of Activity

Quality Parameter Test	Food Safety	Brewing Process Efficiency	Beer Quality
Food Safety	✓	-	-
Filtration Prediction	-	✓	-
Fermentability Prediction	-	✓	-
Beer Foam Prediction	-	-	✓
Malt Color	-	-	✓
Malt Anti Oxidant	-	-	✓
MALT TASTE PROFILE	-	-	✓

Our interest in malt flavor has also been stimulated from another quite different source. BRI has been interested in Sensory Technology for many years and the research studies which have been undertaken have contributed greatly to the industry's knowledge. Our current interest ranges from fundamental studies in the organoleptic properties of beer (e.g. time-intensity tasting) to more commercial work. In certain of our confidential projects, the ability to relate consumer perception of brand quality to that of the brewer's idea of quality, became very desirable. The contribution of malt to flavor quality, whether directly or indirectly, thus became a very important issue. The relationship "marketplace to malt" is shown in Table 2.

**Table II**  
Sensory Analysis of Malt

#### 1. SENSORY BEER PROFILE : MALT TASTE RELATIONSHIP



We have used this model in a number of ways: new product design, investigations of brand flavor problems, etc. Work continues to refine the relationship.

The sensory evaluation of malt has proved to be a very fruitful area of investigation. This paper deals with some of the work carried out at BRI over the past three years and reported to the BRI Membership. Specialty malts have been the main source of interest because of their pronounced flavor impact on beer. However, more and more interest is being shown in the work relating to lager malts and their impact on the flavor of lager beer.

## EXPERIMENTAL

### Pre-treatment of malt

BRI advocates that all malt samples which are submitted for sensory analysis should be treated either by ultraviolet irradiation or microwave heat treatment. As a precautionary step, any contamination which may arise due to exceptional circumstances such as infection during storage or poor handling practice, is eradicated. In this instance BRI has adopted a simple microwave treatment (40 seconds per 13g at 650W). This treatment has been found to significantly reduce the numbers of coliform organisms present on malt samples and has no deleterious effect on flavor.

### Selection of tasting method

Exploratory work at BRI<sup>1</sup> identified a preferred method for the presentation of malt samples for sensory analysis using milled, wetted malt. This method of tasting allows sensorial contributions from both the husk and the malted endosperm to be appreciated as well as overall textural (mouthfeel) qualities.

### Preparation of samples

Following pre-treatment, the samples are ground using a Bühler-Miag mill at disc setting 0.7mm and mixed with Analytical Reagent grade water (Fisher Scientific UK Limited, Bishop Meadow Road, Loughborough, Leicestershire, LE11 5RG, UK Tel: 01509 231166) at a ratio of 6:4 water to grist. Individual samples (approximately 8g per person) are placed immediately into sterile lidded 90mm petri dishes (Bibby Sterilin Limited, Stone, Staffordshire, ST15 0SA, UK Tel: 01785 812121). Assessors are first asked to sniff the prepared sample and then taste it using a disposable plastic spoon. Chilled, filtered water is provided to cleanse the palate between samples and to alleviate palate fatigue.

### Generation of terminology

For the preliminary tasting sessions, the method of Quantitative Descriptive Analysis (QDA) was adopted, whereby assessors were encouraged to develop their own descriptive language relating specifically to detectable aroma and taste characteristics. A range of commercial lager and ale malts were supplied by Hugh Baird & Sons, Station Maltings, Witham, Essex CM8 2DU Tel: 01376 513566.

The total number of descriptors generated by eight panelists at this stage was in excess of fifty. In order to produce a generalized malt profile format, individual terms were grouped collectively into eight attributes, i.e. cereal, sweet, burnt, nutty,

**Brewing Research International  
Malt Tasting**

Name: \_\_\_\_\_ Date: \_\_\_\_\_  
Sample: \_\_\_\_\_ Time: \_\_\_\_\_

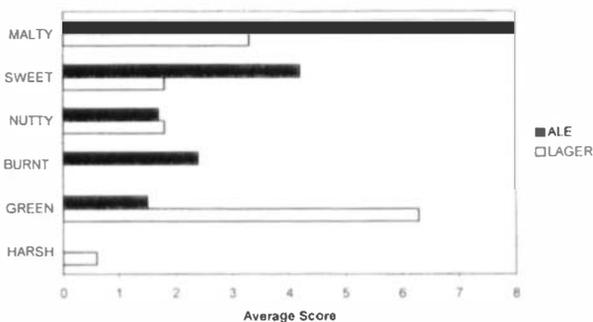
Score on a 0 to 9 scale

	Aroma	Taste	Comments
Malty			
Sweet			
Burnt			
Nutty			
Green			
Sulphury			
Solvent/Wet			
Other			

Linger	After Palate (Finish) Comments
0 Short - 9 Long	

**COMMONLY USED TERMS**  
**MALTY:** Biscuit, Bournvita, Cereal, Hay, Horlicks, Husky, Malty, Muesli, Ovaltine, Pastry, Rusks, Ryvita  
**SWEET:** Honey, Sweet, Toffee, Vanilla  
**NUTTY:** Chestnut, Nutty, Peanut  
**GREEN:** Beany, Cauliflower, Fruity, Grainy, Grassy, Green, Pea, Rotting, Seaweed, Sprouting, Steep Tank  
**SULPHURY:** Cooked Veg, DMS, Sulphidic, Sulphitic  
**BURNT:** Baked, Bonfire, Burnt, Roast, Toast  
**SOLVENT/WET:** Cardboard, Chlorine, Earthy, Emulsion (Paint), Muddy, Paper, Phenolic  
**OTHER:** Acidic, Astringent, Compost, Leather, Metallic, Musty, Sharp, Sweaty, Wet Fibres

**FIGURE 1**  
Brewing Research International Malt Tasting



**FIGURE 2**  
Taste Scores of Standard Lager and Ale Malts

green, sulphur, harsh and linger (assessors were asked to assign any flavors which did not fit into a specific attribute category as "other"). The profile form is illustrated in Figure 1. Assessors were asked to record the intensities of both aroma and taste using a 0-9 scale, 0 being absent and 9 being extreme for each flavor attribute. The glossary for descriptors within each category is outlined later (Table III). Average scores for both aroma and taste were calculated, using a panel of eight assessors and the taste scores for standard lager and ale malts are illustrated in Figure 2.

**TABLE III**  
Flavor Descriptors for Malt Profiling

**MALT TASTING - GLOSSARY**

All descriptors for aroma and taste on a 0-9 scale

- CEREAL:** Cookie, Biscuit, Bournvita, Cereal, Hay, Horlicks, Husky, Malt, Muesli, Ovaltine, Pastry, Rusks, Ryvita
- SWEET:** Honey, Sweet
- BURNT:** Burnt, Toast, Roast
- NUTTY (GREEN):** Beany, Cauliflower, Grainy, Grassy, Green pea, Seaweed, Bean sprout
- NUTTY (ROAST):** Chestnut, Peanut, Walnut, Brazil nut
- SULPHURY:** Cooked vegetable, DMS, Sulphidic, Sulphitic
- HARSH:** Acidic, Sour, Sharp
- TOFFEE:** Toffee, Vanilla
- CARAMEL:** Caramel, Cream Soda
- COFFEE:** Espresso Coffee
- CHOCOLATE:** Dark Chocolate
- TREACLE:** Treacle, Treacle toffee
- SMOKY:** Bonfire, Wood fire, Peaty, Wood ash
- PHENOLIC:** Spicy, Medicinal, Herbal
- FRUITY:** Fruit jam, Bananas, Citrus, Fruitcake
- BITTER:** Bitter, Quinine
- ASTRINGENT:** Astringent, Mouth puckering
- OTHER:** Cardboard, Earthy, Damp, Paper
- LINGER:** Duration/intensity of after-taste

**Specialty Malts**

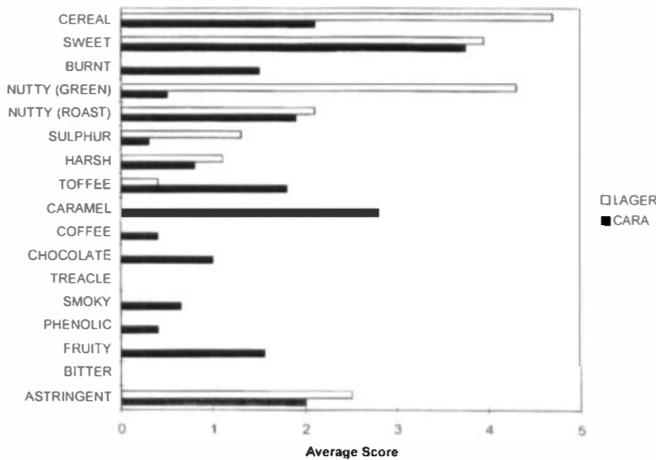
When tasting specialty malts, ranging from pale ale malts (4° EBC) to black malt (1100° EBC), a number of extra terms were required. The original term "malty" was replaced with "cereal" to include biscuit, cereal and bran notes. "Nutty" was divided into green and roast components and important flavor attributes including "toffee," "caramel," "coffee" and "chocolate" were added to the list.

**a) Cara Malt**

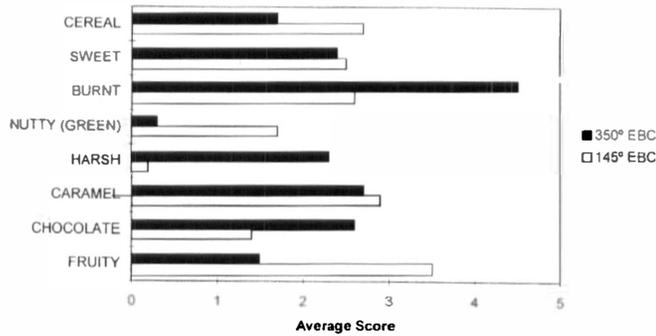
The caramelization involved in cara malt production reduces green/cereal flavor notes in comparison to standard lager malts, as shown in Figure 3, which illustrates average taste scores only. There are also distinct increases in the scores for toffee, caramel and fruity.

**b) Crystal Malts**

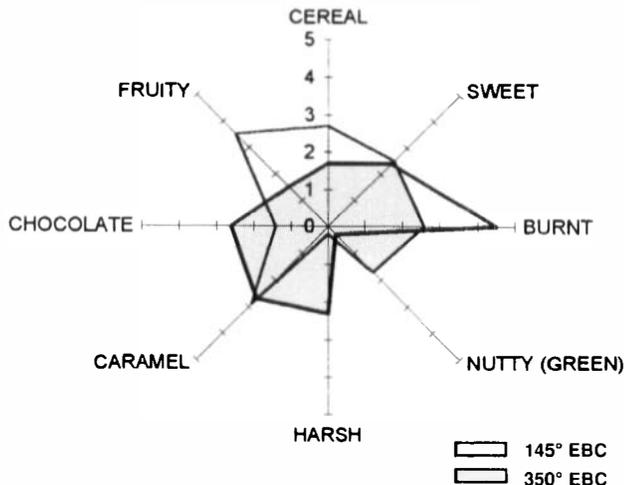
Good discrimination is shown in Figure 4 between two crystal malts (145° EBC and 350° EBC). This information can be represented alternatively as a radar (spider) diagram, as seen in Figure 5, giving each malt a type of "fingerprint" by its shape of plot. It is clear that there are perceivable flavor differences between these two malts which in a commercial sense should be exploited when designing beers within a new or existing niche in the marketplace.



**FIGURE 3**  
Taste Scores of Lager Malt (4° EBC) and Cara Malt (35° EBC)



**FIGURE 4**  
Taste Scores of 2 Crystal Malts



**FIGURE 5**  
Radar Diagram of 2 Crystal Malts

**Chocolate and Black Malts**

Dramatic differences between lager malt and chocolate malt (950° EBC) also can be shown with substantial burnt, coffee and smoky notes being enhanced in chocolate malt. Black malt (1100° EBC) was described in a similar way to chocolate malt, the main difference being the absence of any pronounced sweet flavor notes.

**Low Color Cara Malt**

BRI has used its tasting and malting expertise (and new specialty malt roaster) to create a new style of malt, low color cara malt at 15° EBC color specification. This malt can be used at much higher percentages in the grist to deliver fuller flavors yet contributing little to beer color.

**Lager Malt**

Specialty malts such as crystal malt can have a profound impact on the flavor profile of beer when used as a significant proportion of the grist. Lager malt, on the other hand, is designed to have a much more subtle effect. However, by applying our malt tasting expertise, BRI has been able to describe the differing flavor impact, especially on palate and late-palate, which lager malts of very similar specifications may have on a particular beer brand. The effect of lager malt taste on lager brands which have a subtle, less robust flavor profile, can indeed be significant.

**Malt Selection and Beer Drinkability**

Typically, North American and Japanese lager beer brands are susceptible to manifesting harsh flavor notes on the late palate. These flavors can be carried forward from malt in one form or another to give drinkability problems. On the other hand, malts which are made from barley varieties grown in low stress conditions provide smooth palate notes which considerably enhances the palatability of certain beer brands. The absence of "challenging" flavors, which can cause palate fatigue by building up during drinking, makes these malts highly desirable for beers which claim a "fast finish." We surmise that this interaction is caused by a protein/polyphenol palate interaction.

**FLAVOR SPECIFICATIONS FOR MALTS - POSSIBLE OR ACHIEVABLE?**

Most purchasing decisions are based almost entirely on a full analytical description. In reality, however, it is often the case that malt can be "in spec" analytically yet give cause for concern to the brewer if an unusual flavor develops in the final beer. Investigations into the potential source of the taint almost inevitably focus their attention on the malt. It is, therefore, vital to instigate a rigorous method of tasting malt that can generate a usable flavor descriptor that clearly indicates those positive flavor notes which should be present, or undesirable flavors that must be excluded.

When evaluating suppliers it has previously been difficult to show analytically that there is a difference in the flavor of malt. Of course it is possible to measure the levels of heterocyclic and other Maillard and Strecker compounds in the sample,

but the interaction of these compounds is only apparent to the human palate.

The following case study illustrates how it is now possible to use malt tasting to set a flavor specification.

A company purchased malt from four suppliers which were "in spec" yet suspected of creating a flavor problem downstream. These malts were tasted and could be easily grouped into two pairs. When the flavor profiles were shown as radar diagram, it was immediately obvious that there were distinct shapes. The desirable malts were chosen as the "benchmark" for purchasing.

The client now uses this new benchmark profile to evaluate malt intended for use in the brewery. The profiles are valuable in discussions with maltsters to ensure that the positive flavors of the acceptable malts are maximized.

The BRI malt tasting system has also been used to identify unusual flavors that are thought to have originated from malt. This taint identification system complements standard analytical methods. The malt panel at BRI can often identify the nature of a taint and suggest areas in the process that should be examined to eliminate the problem.

## **SUMMARY**

This paper explores the sensory relationship between beer flavor and the taste of malt. Malt taste protocols have been developed and their potential use within the 'malt specification' examined. The idea of designing malts - especially specialty malts - has been developed. Use of the new malt roaster at BRI has facilitated this work. The exploitation of specific barley varieties for particular lager brands is also discussed.

## **FOOTNOTE**

<sup>1</sup> Available from French and Juppés, Ltd. THE MALTINGS, Stanstead Abbots Hertfordshire SG12 8HG England, UK