



Forschung, Lehre, Beratung,  
Information und Dienstleistung  
seit 1963

Versuchs- und Lehranstalt für Brauerei in Berlin e. V., Seestr.13, 13353 Berlin

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Berlin, 02<sup>nd</sup> January 2013

**Sauer & Hartwig - Sensory Evaluation**

**Performance of PET vs. Metal Keg containers**

**(April to December 2012)**

**Versuchs- und Lehranstalt für Brauerei in Berlin (VLB) e.V.**

Department of  
Brewing and Beverage Science and Applications  
Seestraße 13, 13353 Berlin

Dear Mr. Hartwig,

In compliance to your request to the VLB Berlin of several series of sensory evaluations for comparison of PET and Metal Keg containers, you can find below the results of the complete trial of nine months of storage.

**I) Tasting results – zero value:**

<b>Date of Tasting:</b>	04.04.2012
<b>Type of Tasting:</b>	Triangle-Test
<b>Number of Tasters:</b>	10
<b>Sample(s) analysed:</b>	
Type of beer	
Pils	
<b>Result(s):</b>	
Number of correct answers	1
Number of wrong answers	9
With a statistical significance level of $\alpha = 0,05\%$ , there is no significant difference.	
<b><u>Additional Comments/Observations:</u></b>	
The beer in the PET container is more aromatic.	

<b>Date of Tasting:</b>	04.04.2012
<b>Type of Tasting:</b>	Triangle-Test
<b>Number of Tasters:</b>	10
<b>Sample(s) analysed:</b>	
Type of beer	
Märzen	
<b>Result(s):</b>	
Number of correct answers	5
Number of wrong answers	5
With a statistical significance level of $\alpha = 0,05\%$ , there is no significant difference.	
<b>Additional Comments/Observations:</b>	
The beer in the PET container is less fresh and less aromatic than the beer in metal container.	

<b>Date of Tasting:</b>	04.04.2012
<b>Type of Tasting:</b>	Triangle-Test
<b>Number of Tasters:</b>	10
<b>Sample(s) analysed:</b>	
Type of Beer	
Märzen Dunkel	
<b>Result(s):</b>	
Number of correct answers	7
Number of wrong answers	3
With a statistical significance level of $\alpha = 0,05\%$ , the tasters were able to detect a difference between the samples.	
<b>Additional Comments/Observations:</b>	
The beer in the PET container is described as having a slight cheesy taste, less CO <sub>2</sub> and less fresh than the beer in the metal container.	

<b>Date of Tasting:</b>	04.04.2012
<b>Type of Tasting:</b>	Triangle-Test
<b>Number of Tasters:</b>	10
<b>Sample(s) analysed:</b>	
<b>Type of Beer</b>	
Pils	
<b>Result(s):</b>	
Number of correct answers	2
Number of wrong answers	8
With a statistical significance level of $\alpha = 0,05\%$ , there is no significant difference.	
<b>Additional Comments/Observations:</b>	
The beer in the PET container has slightly more caramel and coffee taste.	

<b>Date of Tasting:</b>	05.04.2012
<b>Type of Tasting:</b>	Triangle-Test
<b>Number of Tasters:</b>	10
<b>Sample(s) analysed:</b>	
	Type of beer
	Klosterbier
<b><u>Result(s):</u></b>	
Number of correct answers	5
Number of wrong answers	5
With a statistical significance level of $\alpha = 0,05\%$ , there is no significant difference.	
<b><u>Additional Comments/Observations:</u></b>	
The beer in the PET container has less CO <sub>2</sub> , has a cardboard flavour, is more estery and is more watery than the beer in the metal container.	

<b>Date of Tasting:</b>	05.04.2012
<b>Type of Tasting:</b>	Triangle-Test
<b>Number of Tasters:</b>	10
<b>Sample(s) analysed:</b>	
Type of beer	
Kölsch Gaffel	
<b>Result(s):</b>	
Number of correct answers	3
Number of wrong answers	7
<p>With a statistical significance level of <math>\alpha = 0,05\%</math>, there is no significant difference.</p>	
<b>Additional Comments/Observations:</b>	
<p>The beer in the PET container has a fruity aroma, is fresh, with a hint of H<sub>2</sub>S and less aromatic than the beer in the metal container.</p>	

<b>Date of Tasting:</b>	05.04.2012
<b>Type of Tasting:</b>	Triangle-Test
<b>Number of Tasters:</b>	10
<b>Sample(s) analysed:</b>	
Type of Beer	
Schneider Weisse	
<b><u>Result(s):</u></b>	
Number of correct answers	1
Number of wrong answers	9
With a statistical significance level of $\alpha = 0,05\%$ , there is no significant difference.	
<b><u>Additional Comments/Observations:</u></b>	
No comments.	



<b>Date of Tasting:</b>	05.04.2012
<b>Type of Tasting:</b>	Triangle-Test
<b>Number of Tasters:</b>	9
<b>Sample(s) analysed:</b>	
<b>Type of Beer</b>	
Ale	
<b><u>Result(s):</u></b>	
Number of correct answers	2
Number of wrong answers	7
With a statistical significance level of $\alpha = 0,05\%$ , there is no significant difference.	
<b><u>Additional Comments/Observations:</u></b>	
The beer in the PET container is described as less bitter than the beer in the metal container.	

<b>Date of Tasting:</b>	05.04.2012
<b>Type of Tasting:</b>	Triangle-Test
<b>Number of Tasters:</b>	9
<b>Sample(s) analysed:</b>	
<b>Type of Beer</b>	
Weizen mit KZE	
<b><u>Result(s):</u></b>	
Number of correct answers	7
Number of wrong answers	2
With a statistical significance level of $\alpha = 0,01\%$ , the tasters were able to identify the difference between the samples.	
<b><u>Additional Comments/Observations:</u></b>	
The beer in the PET container was described as having a slight sour smell and musty taste.	

<b>Date of Tasting:</b>	05.04.2012
<b>Type of Tasting:</b>	Triangle-Test
<b>Number of Tasters:</b>	9
<b>Sample(s) analysed:</b>	
Type of Beer	
Weizen mit Nachgärung im Keg	
<b>Result(s):</b>	
Number of correct answers	5
Number of wrong answers	4
<p>With a statistical significance level of <math>\alpha = 0,05\%</math>, there is no significant difference.</p>	
<b>Additional Comments/Observations:</b>	
<p>The beer in the PET container with CO<sub>2</sub> was described as fruity, sweet and with banana aroma. In addition, it has less intensive taste and odour and is less sour than the beer in the PET container with air.</p>	

**II) Tasting results – after 3 months of storage:**

<b>Date of Tasting:</b>	12.07.2012
<b>Type of Tasting:</b>	Triangle-Test
<b>Number of Tasters:</b>	10
<b>Sample(s) analysed:</b>	
Type of Beer	
Pils	
<b>Result(s):</b>	
Number of correct answers	8
Number of wrong answers	2
<p>With a statistical significance level of <math>\alpha = 0,01\%</math>, the difference between the beers is noticeable.</p>	
<b>Additional Comments/Observations:</b>	
<p>The beer in the PET container was described as sour, sweet, slightly sulphuric and less fresh. It was also reported to miss on bitter notes.</p>	

<b>Date of Tasting:</b>	12.07.2012
<b>Type of Tasting:</b>	Triangle-Test
<b>Number of Tasters:</b>	10
<b>Sample(s) analysed:</b>	
Type of Beer	
Märzen Bernstein Unfiltrat lebende Hefe	
<b>Result(s):</b>	
Number of correct answers	3
Number of wrong answers	7
With a statistical significance level of $\alpha = 0,05\%$ , there is no significant difference.	
<b>Additional Comments/Observations:</b>	
The beer in the PET container was described as sweeter than the beer in KEG containers, having better hop aroma.	

<b>Date of Tasting:</b>	12.07.2012
<b>Type of Tasting:</b>	Triangle-Test
<b>Number of Tasters:</b>	10
<b>Sample(s) analysed:</b>	
Type of Beer	
Märzen Dunkel Filtrat	
<b>Result(s):</b>	
Number of correct answers	9
Number of wrong answers	1
With a statistical significance level of $\alpha = 0,001\%$ , the difference between the beers is noticeable.	
<b>Additional Comments/Observations:</b>	
The beer in the PET container was described as having a malty aroma and odour. It is considered less sour than the beer in KEG container.	

<b>Date of Tasting:</b>	12.07.2012
<b>Type of Tasting:</b>	Triangle-Test
<b>Number of Tasters:</b>	10
<b>Sample(s) analysed:</b>	
Type of Beer	
Pils	
<b>Result(s):</b>	
Number of correct answers	3
Number of wrong answers	7
With a statistical significance level of $\alpha = 0,05\%$ , there is no significant difference.	
<b><u>Additional Comments/Observations:</u></b>	
The beer in the metal KEG container was described as having a less intense malt odour. Two tasters described the beer as slightly older in taste.	

<b>Date of Tasting:</b>	12.07.2012
<b>Type of Tasting:</b>	Triangle-Test
<b>Number of Tasters:</b>	10
<b>Sample(s) analysed:</b>	
Type of Beer	
Klosterbock	
<b>Result(s):</b>	
Number of correct answers	4
Number of wrong answers	6
With a statistical significance level of $\alpha = 0,05\%$ , there is no significant difference.	
<b>Additional Comments/Observations:</b>	
The beer in the metal KEG container was described as more estery.	



<b>Date of Tasting:</b>	12.07.2012
<b>Type of Tasting:</b>	Triangle-Test
<b>Number of Tasters:</b>	10
<b>Sample(s) analysed:</b>	
Type of Beer	
Kölsch	
<b>Result(s):</b>	
Number of correct answers	3
Number of wrong answers	7
<p>With a statistical significance level of <math>\alpha = 0,05\%</math>, there is no significant difference.</p>	
<b>Additional Comments/Observations:</b>	
<p>Two tasters described the beer in the metal KEG container as slightly more aged than the beer in PET container.</p>	

<b>Date of Tasting:</b>	13.07.2012
<b>Type of Tasting:</b>	Triangle-Test
<b>Number of Tasters:</b>	10
<b>Sample(s) analysed:</b>	
Type of Beer	
Weizen mit Nachgärung im Keg	
<b>Result(s):</b>	
Number of correct answers	4
Number of wrong answers	6
With a statistical significance level of $\alpha = 0,05\%$ , there is no significant difference.	
<b>Additional Comments/Observations:</b>	
The beer in the metal KEG container was described as with more intense fruity odour and more watery. Hop notes were considered to be missing.	

<b>Date of Tasting:</b>	13.07.2012
<b>Type of Tasting:</b>	Triangle-Test
<b>Number of Tasters:</b>	10
<b>Sample(s) analysed:</b>	
Type of Beer	
Ale Unfiltrat	
<b>Result(s):</b>	
Number of correct answers	4
Number of wrong answers	6
With a statistical significance level of $\alpha = 0,05\%$ , there is no significant difference.	
<b><u>Additional Comments/Observations:</u></b>	
The beer in the metal KEG container has milder taste than the beer in PET container.	

<b>Date of Tasting:</b>	13.07.2012
<b>Type of Tasting:</b>	Triangle-Test
<b>Number of Tasters:</b>	10
<b>Sample(s) analysed:</b>	
Type of Beer	
Weizen über KZE	
<b>Result(s):</b>	
Number of correct answers	5
Number of wrong answers	5
With a statistical significance level of $\alpha = 0,05\%$ , there is no significant difference.	
<b><u>Additional Comments/Observations:</u></b>	
The beer in the PET container was slightly less fresh and with less fizziness than the beer in metal KEG container. It was reported as having a banana aroma and a slightly solvent odour.	



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<b>Date of Tasting:</b>	13.07.2012
<b>Type of Tasting:</b>	Triangle-Test
<b>Number of Tasters:</b>	4 (with clients)
<b>Sample(s) analysed:</b>	
Type of Beer	
Pils	
<b>Result(s):</b>	
Number of correct answers	2
Number of wrong answers	2
<b>Additional Comments/Observations:</b>	
The beer in the metal KEG container was described as slightly fresher.	

**III) Tasting results – after 6 months of storage:**

<b>Date of Tasting:</b>	04.10.2012
<b>Type of Tasting:</b>	Triangle-Test
<b>Number of Tasters:</b>	10
<b>Sample(s) analysed:</b>	
Type of Beer	
Märzen Bernstein Unfiltrat lebende Hefe	
<b><u>Result(s):</u></b>	
Number of correct answers	5
Number of wrong answers	5
<p>With a statistical significance level of <math>\alpha = 0,05\%</math>, there is no significant difference.</p>	
<b><u>Additional Comments/Observations:</u></b>	
<p>The beer in the PET container was described as slightly sour, whereas the beer in Keg was considered fresher.</p>	

<b>Date of Tasting:</b>	04.10.2012
<b>Type of Tasting:</b>	Triangle-Test
<b>Number of Tasters:</b>	10
<b>Sample(s) analysed:</b>	
Type of Beer	
Märzen Dunkel Filtrat	
<b>Result(s):</b>	
Number of correct answers	10
Number of wrong answers	0
<p>With a statistical significance level of <math>\alpha = 0,001\%</math>, it was possible to detect the difference between the samples.</p>	
<b><u>Additional Comments/Observations:</u></b>	
<p>The beer in the metal KEG container was described as very sour.</p>	

<b>Date of Tasting:</b>	04.10.2012
<b>Type of Tasting:</b>	Triangle-Test
<b>Number of Tasters:</b>	10
<b>Sample(s) analysed:</b>	
Type of Beer	
Pils	
<b><u>Result(s):</u></b>	
Number of correct answers	4
Number of wrong answers	6
With a statistical significance level of $\alpha = 0,05\%$ , there is no significant difference.	
<b><u>Additional Comments/Observations:</u></b>	
No comments.	



<b>Date of Tasting:</b>	04.10.2012
<b>Type of Tasting:</b>	Triangle-Test
<b>Number of Tasters:</b>	10
<b>Sample(s) analysed:</b>	
	Type of Beer
	Klosterbock
<b><u>Result(s):</u></b>	
Number of correct answers	5
Number of wrong answers	5
With a statistical significance level of $\alpha = 0,05\%$ , there is no significant difference.	
<b><u>Additional Comments/Observations:</u></b>	
The beer in the metal KEG container was described as more esterfull.	

<b>Date of Tasting:</b>	04.10.2012
<b>Type of Tasting:</b>	Triangle-Test
<b>Number of Tasters:</b>	10
<b>Sample(s) analysed:</b>	
Type of Beer	
Kölsch	
<b>Result(s):</b>	
Number of correct answers	4
Number of wrong answers	6
<p>With a statistical significance level of <math>\alpha = 0,05\%</math>, there is no significant difference.</p>	
<b><u>Additional Comments/Observations:</u></b>	
<p>The beer in the metal KEG container was described as less carbonated and with a slightly unpleasant bitterness.</p>	

<b>Date of Tasting:</b>	05.10.2012
<b>Type of Tasting:</b>	Triangle-Test
<b>Number of Tasters:</b>	10
<b>Sample(s) analysed:</b>	
Type of Beer	
Weizen mit Nachgärung im Keg	
<b>Result(s):</b>	
Number of correct answers	5
Number of wrong answers	5
<p>With a statistical significance level of <math>\alpha = 0,05\%</math>, there is no significant difference.</p>	
<b>Additional Comments/Observations:</b>	
<p>The beer in the metal KEG container was described as having slightly more yeast taste, a solvent aroma and as having more CO<sub>2</sub> content. The beer in the PET container was rated as more pleasant / balanced and as having a stronger isoamylacetate impression.</p>	

<b>Date of Tasting:</b>	05.10.2012
<b>Type of Tasting:</b>	Triangle-Test
<b>Number of Tasters:</b>	10
<b>Sample(s) analysed:</b>	
Type of Beer	
Ale Unfiltrat	
<b><u>Result(s):</u></b>	
Number of correct answers	2
Number of wrong answers	8
With a statistical significance level of $\alpha = 0,05\%$ , there is no significant difference.	
<b><u>Additional Comments/Observations:</u></b>	
No comments.	

<b>Date of Tasting:</b>	05.10.2012
<b>Type of Tasting:</b>	Triangle-Test
<b>Number of Tasters:</b>	10
<b>Sample(s) analysed:</b>	
Type of Beer	
Weizen über KZE	
<b>Result(s):</b>	
Number of correct answers	6
Number of wrong answers	4
<p>With a statistical significance level of <math>\alpha = 0,05\%</math>, there is no significant difference.</p>	
<b>Additional Comments/Observations:</b>	
<p>The beer in the PET container was slightly less fresh and had lower CO<sub>2</sub> content than the beer in the metal KEG container, which was described as more balanced.</p>	

**IV) Tasting results – after 9 months of storage:**

<b>Date of Tasting:</b>	13.12.2012
<b>Type of Tasting:</b>	Triangle-Test
<b>Number of Tasters:</b>	13
<b>Sample(s) analysed:</b>	
Type of Beer	
Pils	
<b><u>Result(s):</u></b>	
Number of correct answers	13
Number of wrong answers	0
<p>With a statistical significance level of <math>\alpha = 0,001\%</math>, it was possible to detect a difference between the two beers.</p>	
<b><u>Additional Comments/Observations:</u></b>	
<p>The beer in PET keg had a lactic acid contamination, resulting in the significant difference detected.</p>	

**Date of Tasting:** 13.12.2012  
**Type of Tasting:** Triangle-Test  
**Number of Tasters:** 13

**Sample(s) analysed:**

Type of Beer

Märzen Bernstein Unfiltrat lebende Hefe

**Result(s):**

Number of correct answers	6
Number of wrong answers	7

With a statistical significance level of  $\alpha = 0,05\%$ , there is no significant difference.

**Additional Comments/Observations:**

Both beers were described by the panel of tasters as sour, with lactic acid impression.

<b>Date of Tasting:</b>	13.12.2012
<b>Type of Tasting:</b>	Triangle-Test
<b>Number of Tasters:</b>	13
<b>Sample(s) analysed:</b>	
Type of Beer	
Pils	
<b>Result(s):</b>	
Number of correct answers	6
Number of wrong answers	7
<p>With a statistical significance level of <math>\alpha = 0,05\%</math>, there is no significant difference.</p>	
<b><u>Additional Comments/Observations:</u></b>	
<p>All the tasters referred that there were hardly any differences between the beers. The beer in PET keg was however referred by two tasters as oxidized. The beer in the metal keg was described as more carbonated than the beer in the PET keg.</p>	



**Date of Tasting:** 13.12.2012  
**Type of Tasting:** Triangle-Test  
**Number of Tasters:** 10

**Sample(s) analysed:**

Type of Beer

Klosterbock

**Result(s):**

Number of correct answers	4
Number of wrong answers	6

With a statistical significance level of  $\alpha = 0,05\%$ , there is no significant difference.

**Additional Comments/Observations:**

The tasters reported difficulties in finding differences between the two beers.

<b>Date of Tasting:</b>	13.12.2012
<b>Type of Tasting:</b>	Triangle-Test
<b>Number of Tasters:</b>	10
<b>Sample(s) analysed:</b>	
Type of Beer	
Kölsch	
<b>Result(s):</b>	
Number of correct answers	4
Number of wrong answers	6
<p>With a statistical significance level of <math>\alpha = 0,05\%</math>, there is no significant difference.</p>	
<b>Additional Comments/Observations:</b>	
<p>Both beers were described as oxidized by two tasters. The beer in PET keg was rated as having a cardboard aroma and less CO<sub>2</sub>. The beer in Metal keg was considered as bready.</p>	

**Date of Tasting:** 13.12.2012  
**Type of Tasting:** Triangle-Test  
**Number of Tasters:** 10

**Sample(s) analysed:**

Type of Beer

Weizen

**Result(s):**

Number of correct answers	7
Number of wrong answers	3

With a statistical significance level of  $\alpha = 0,05\%$ , it was possible to detect a difference between the two beers.

**Additional Comments/Observations:**

The beer in metal keg was considered less fruity and less balanced as the beer in the PET keg, however with more carbonation and fresher. The beer in PET keg was described by two tasters as slightly oxidized.

**Date of Tasting:** 14.12.2012  
**Type of Tasting:** Triangle-Test  
**Number of Tasters:** 10

**Sample(s) analysed:**

Type of Beer

Ale Unfiltrat

**Result(s):**

Number of correct answers	6
Number of wrong answers	4

With a statistical significance level of  $\alpha = 0,05\%$ , there is no significant difference.

**Additional Comments/Observations:**

The beer in the PET keg was rated as having a slight impression of old hops. The beer in Metal keg was considered fresher and more intense in odour and taste.

**Date of Tasting:** 14.12.2012  
**Type of Tasting:** Triangle-Test  
**Number of Tasters:** 10

**Sample(s) analysed:**

Type of Beer  
Weizen über KZE

**Result(s):**

Number of correct answers	5
Number of wrong answers	5

With a statistical significance level of  $\alpha = 0,05\%$ , there is no significant difference.

**Additional Comments/Observations:**

The tasters reported difficulties in finding differences between the two beers.

**V) Conclusion of the trial:**

In the complete trial of 9 months, the development of the different beers tested was generally similar when stored in metal and in PET Kegs, leading to the conclusion that both types of Kegs have similar performance along the storage time.

We hope we fulfilled your expectations and that these results can help you characterize the analyzed containers. We are available to continue supporting and working in collaboration with Sauer & Hartwig.

With kind regards,



Patrícia Diniz



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