



# Barley varieties registered in the Slovak Republic after harvest 2018

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## Abstract

We present the malting quality and agronomic characters data obtained within a three-year testing of barley varieties for the registration in the Slovak Republic. After harvest 2018, new spring barley malting varieties Chimbon, Laureate and LG Aurus were registered. The extract content in dry matter in the studied varieties was high and ranged from 83.1–83.5%. The varieties had strong proteolytic modification (Kolbach index 49.5–50.7%). Amylolytic and cytolytic modification was at the optimal level. Wort quality was optimal (apparent final attenuation 81.5–82.2%).

**Key words:** barley, variety, malting quality

## 1 Introduction

In the Slovak Republic, new barley varieties are registered under Act 597/2006 on the basis of a three-year testing. The tests for the registration of new varieties involve the monitoring of the utility value, i.e. yield and other yield characteristics, resistance to diseases, lodging and traits characterizing malt quality. The quality of malt samples was evaluated on the basis of the characteristics given in the malting quality indicator. The quality of malt samples was assessed based on the characters given in the malting quality index (Psota and Kosař, 2002).

This study evaluates the technological and agronomical quality of the spring barley malting varieties Chimbon, Laureate, and LG Aurus, which in 2018 completed the trials for the registration (Tables 1, 2, 3).

## 2 Material and Methods

The list of all barley varieties registered after harvest 2018 is given in Table 1. Information on agronomical characteristics of the varieties was obtained as part of

the state varietal tests of the Slovak Republic from the testing stations of the Central Controlling and Testing Institute in Agriculture in Bratislava (CCTIA).

Malting quality of spring barley varieties was assessed based on the micromalting test and subsequent analytical analysis of malt and wort. Seed samples for the micromalting tests were delivered by the Department of Variety Testing CCTIA in Bratislava, in 2016–2018. Grain samples of the tested varieties were collected annually from four testing stations where the standard varieties exhibited the optimal content of nitrogenous substances (10.2–11.2%). Samples (0.5 kg) were malted in the micromalting plant of the KVM company (CR). The method traditionally used in the Research Institute of Brewing and Malting, which is almost identical with the MEBAK method (2011), was used for laboratory malting. Steeping was conducted in the steeping box. The temperature of both water and air was kept at 14.0 °C. Length of steeping: 1<sup>st</sup> day – 5 hours; 2<sup>nd</sup> day – 4 hours. On the third day the water content in germinating grains was adjusted to the value of 45% by steeping or spraying. Germination

was conducted in the germination box. The temperature during germination was 14.0 °C. The total time of steeping and germination was 144 h.

Kilning was performed on a one-floored electrically heated kiln. The total kilning time was 22 h, prekilning at 55 °C, kilning temperature was 80 °C for 4 hours.

In the course of the tests, Malt-ing Quality Index (nitrogenous substances in non-malted grain, extract in malt dry matter, relative extract at 45 °C, Kolbach index, diastatic power, apparent final attenuation, friability,  $\beta$ -glucans in wort, wort clarity and haze) was determined according to the methods presented in publications of [MEBAK \(2011\)](#) and [EBC \(2010\)](#). The variety was assessed according to the malting quality index ([Psota and Kosař, 2002](#)). Wort clarity determined visually was assessed as follows: 1 = clear, 2 = weakly opalizing, 3 = opalizing, 4 = cloudy ([Table 2](#)).

Agricultural characters of varieties include ([Table 3](#)):

– yield of grain at standard 14% moisture content. Yield of grain and yield of grain over 2.5 mm in spring barley in terms of the response of the varieties to the soil and

weather conditions and suitability of the use of grain for malting are assessed within the production area (maize, sugar-beet, potato and mountain).

– agronomical data (time to heading, maturity, straw length, resistance to lodging).

– resistance to diseases (powdery mildew of barley (*Blumeria graminis*), leaf brown rust of barley (*Puccinia hordei*), net blotch of barley (*Pyrenophora teres*), scald of barley (*Rhynchosporium secalis*)).

– quality parameters of the grain (thousand grain weight and sievings over 2.0 mm).

**Table 1** Collection of registered spring barley varieties after harvest 2018

Variety Code	Maintainer Agent in the SR
<b>spring barley</b>	<b>malting varieties</b>
<b>Chimbon</b> AC11/684/120	Ackermann Saat-zucht GmbH & CO.KG Rapool Slovakia, s.r.o.
<b>Laureate</b> SY412-328	Syngenta Participations AG RWA Slovakia, s.r.o.
<b>LG Aurus</b> LGBHE3427A	Limagrain Europe Limagrain Central Europe Cereals, s.r.o.

**Table 2** Barley grain and malt analyses (2016–2018)

Methods		References	Odyssey	LG Aurus	Chimbon	Laureate
			<b>S</b>			
Protein content of barley (factor 6.25) d.m.	%	EBC 2010 3.3.1	10.2	10.4	10.4	10.3
Extract of malt (congress mash) d.m.	%	EBC 2010 4.5	83.3	83.5	83.1	83.4
Mash method according to Hartong and Kretschmer VZ 45 °C	%	MEBAK 2011 4.1.4.11	44.2	46.6	46.8	47.4
Kolbach index	%	EBC 2010 4.9.1	48.9	49.5	50.7	49.9
Diastatic power	WK	EBC 2010 4.12	319	318	368	321
Final attenuation of laboratory wort	%	EBC 2010 4.11	82.0	82.1	82.2	81.5
Friability	%	EBC 2010 4.15	92	93	91	92
High molecular weight beta-glucan content of malt, SFA	mg/l	EBC 2010 4.16.2	123	137	109	152
Appearance (clarity) of wort		MEBAK 2011 3.1.4.2.6	1.00	1.08	1.00	1.25
Haze of wort (90°)	EBC	EBC 2010 9.29	0.97	0.77	0.59	1.65
Haze of wort (12°)	EBC	EBC 2010 9.29	1.39	1.03	0.64	1.80
S = standard variety						

**Table 3** Important agricultural properties (2016–2018)

Variety	Mean of the test	Laudis 550	Signora	Odyssey	LG Aurus	Chimbon	Laureate
<b>Grain yield</b>	(t.ha <sup>-1</sup> )	S	S	S			
maize production area	6.93	6.95	6.71	6.86	6.79	6.76	7.32
sugar-beet production area	6.92	6.75	6.46	6.76	7.20	6.95	7.18
potato and mountain production area	7.44	7.46	6.99	7.85	7.69	7.46	7.84
<b>Grain yield over 2.5 mm</b>							
maize production area	6.79	6.74	6.58	6.72	6.65	6.56	7.17
sugar-beet production area	6.71	6.62	6.33	6.56	6.98	6.67	7.11
potato and mountain production area	7.29	7.24	6.85	7.61	7.61	7.24	7.68
<b>Agronomic data</b>							
straw length (cm)		76	76	76	76	74	75
earliness of ripening (days compared to Odyssey)		-2	-1	0	-2	-2	0
standing power (lodging resistance)		8.1	8.1	6.8	7.2	6.7	7.3
<b>Resistance to diseases</b>							
powdery mildew of barley ( <i>Blumeria graminis</i> )		8.2	8.2	8.0	8.2	8.4	8.2
leaf brown rust of barley ( <i>Puccinia hordei</i> )		6.4	6.5	5.6	6.0	5.8	6.3
net blotch of barley ( <i>Pyrenophora teres</i> )		5.0	4.8	5.8	5.8	5.5	5.8
scald of barley ( <i>Rhynchosporium secalis</i> )		7.9	8.2	8.0	7.9	7.8	8.2
<b>Mechanical properties (grain quality)</b>							
1000 grain weight (g)		47.0	51.0	51.0	52.0	51.0	51.0
sieving fractions over 2.5 mm (%)		97.3	98.1	97.7	98.2	97.0	98.3
S = standard varieties							

Point evaluation: 1 = fully lodging, fully attacked      9 = non lodging, resistant to diseases  
 Weight of 1000 grains relates to sieving fractions over 2.0 mm at 14% humidity.

### 3 Results

The present study evaluates the spring barley variety registered in the Slovak Republic after harvest 2018 according to the Malting Quality Index (Psota and Kosař, 2002).

The variety **Chimbon**, bred in Germany, gave malt with the optimal extract content (83.1%) at the content of nitrogenous substances in non-malted grain of 10.4%. Proteolytic modification was strong. The wort exhibited high values of soluble nitrogen (861 mg/l). Relative extract at 45 °C characterizing the activity of namely cytolytic and proteolytic enzymes was at the optimal level (46.8%). Amylolytic modification was high (diastatic power 368 WK units). Degradation of cell walls was at the low level of 91% and  $\beta$ -glucan content was on average around 109 mg/l. The variety provided optimal wort quality, apparent final attenuation was on average around 82.2%. The variety provided in all cases clear wort. Considering the achieved values of the studied technological parameters, the variety Chimbon has a malting quality with the point evaluation 8 (7.7).

The variety Chimbon was recorded in the Common catalogue of varieties of agricultural plant species in Poland (European Commission, 2019) and is admitted in Denmark and Austria.

Chimbon is a mid-early spring barley variety with the vegetation period of 107 days and the heading time of 65 days and is of mid-high type (74 cm) with a lower resistance to lodging. The variety has a good resistance to powdery mildew of barley. It is sensitive to net blotch of barley. Grain is big (TGW 51 g) and the portion of sieving fractions is high (97%).

During the tests in 2016 to 2018, the variety Chimbon achieved above average yields in the sugar-beet production area and potato and mountain production area. Compared to the average of the standard varieties in the Slovak Republic, the variety achieved the yield of 7.05 t/ha, i.e. 100.54%.

The British variety **Laureate** provided malt rich in extract (83.4%) at the optimal content of nitrogenous substances in non-malted grain (10.3%). Proteolytic modification was strong (Kolbach index was around 49.9%).

The wort exhibited high values of soluble nitrogen at the level of 848 mg/l. Relative extract at 45 °C characterizing the activity of namely cytolytic and proteolytic enzymes was at the optimal level (47.4%). Amylolytic modification was optimal (diastatic power 321 WK units). Cytolytic modification was above average to optimal. Degradation of cell walls was at the low level of 92% and  $\beta$ -glucan content was around 152 mg/l. The variety provided wort with an optimal composition (apparent final attenuation was on average around 81.5%). The variety provided in most cases clear wort. Considering the achieved values of the studied technological parameters, the variety Laureate has a very good malting quality with the point evaluation 8 (7.6).

The variety Laureate was recorded in the Common catalogue of varieties of agricultural plant species in Poland (European Commission, 2019) and is admitted in Germany, Estonia, France, Lithuania, Latvia, the Netherlands, Austria and the United Kingdom. In 2019 it was also registered in the Czech Republic (Psota et al. 2019). Laureate is a mid-late spring barley variety with the vegetation period of 108 days and the time of heading 67 days and is of a mid-high type (75 cm) with a medium resistance to lodging. The variety has a very good resistance to powdery mildew. It is sensitive to net blotch of barley. The grain is medium high (TGW 51 g) and the portion of sieving fractions is very high (98%).

In the course of the 2016 to 2018 tests, the variety Laureate achieved above average yields in all production areas. Compared to the average of standard varieties in the Slovak Republic, the variety achieved the yield of 7.45 t/ha, i.e. 106.5% (in the maize production area 107%, sugar-beet production area 106% and in the potato and mountain production area 107%).

Malt of the Czech variety **LG Aurus** was rich in extract (83.5%) at the optimal content of nitrogenous substances in non-malted grain (10.4%). Proteolytic modification was strong. The wort exhibited high values of soluble nitrogen (831 mg/l). Relative extract at 45 °C characterizing the activity of namely cytolytic and proteolytic enzymes was at an optimal level (46.6%). Amylolytic modification was high (diastatic power 318 WK units). Cytolytic modification was optimal. Degradation of cell walls was at the low level of 93% and  $\beta$ -glucan content moved around 137 mg/l. The variety provided wort with an optimal composition (apparent final attenuation was on average around 82.1%). The variety provided in most cases clear wort. Considering the achieved values of the technological parameters, the variety LG Aurus has a very good malting quality with the point evaluation 8 (8.0).

In 2019 it was registered in the Czech Republic (Psota et al. 2019).

LG Aurus is mid-early spring barley variety with the vegetation period of 108 days and heading time of 65 days. It is of a mid-high type (76 cm) with medium resistance to lodging. The variety has a good resistance to powdery mildew and is sensitive to net blotch of barley. It has a big grain (TGW 52 g) and the yield of sieving fraction above 2.5 mm is very good (98%). During the 2016 to 2018 tests, the variety LG Aurus achieved above average yields in the sugar-beet and potato and mountain production area. Compared to the average of the control varieties in the Slovak Republic, it achieved the yield of 7.23 t/ha, i.e. 103%.

## 4 Conclusion

The study presents the results achieved by three varieties of spring barley which were registered in the Slovak Republic after the 2018 harvest. Quality was assessed based on the Malting Quality Index. The content of nitrogenous substances in the studied varieties of spring barley was at the optimal level (10.3 to 10.4%). The varieties were rich in extract. More than 83% of extract was recorded in the varieties LG Aurus (83.5%), Laureate (83.4%) and Chimbon (83.1%). Amylolytic and cytolytic modification in the studied varieties of spring barley was mostly at an optimal level. The spring barley varieties had high Kolbach Index (49.5–50.7%). The quality of wort assessed by the apparent final attenuation in the studied varieties of spring barley was at the optimal level (over 82.0%).

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