



Barley varieties registered in the Slovak Republic after the harvest of 2021

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Abstract

After three years of testing, the spring barley varieties of Amidala, Ellinor and LG Belcanto were registered in the Slovak Republic. The extract in dry matter of malt of the varieties studied ranged between 82.3 and 82.8%. The varieties showed optimal to high levels of proteolytic modification (Kolbach index 48.6 to 49.4%) and satisfactory to optimal malt quality (final attenuation 80.9 to 81.5%). Cell wall degradation was optimal (high friability 87 to 92%). The β -glucan content of the wort was satisfactory (174 mg/l) to optimal (68 mg/l).

Key words: barley, variety, malting quality

1 Introduction

The variety and origin of the malting barley grain undoubtedly have a decisive impact on the quality of the malt and also on the quality of the finished beer. This study reports the results of micro-malting obtained from spring barley varieties within state varietal trials of the Slovak Republic.

In the Slovak Republic, new barley varieties are registered under [Act 597/2006](#). Within the tests for the registration, the following characteristics are assessed in new varieties: yield and other yield parameters, resistance to diseases, resistance to lodging and parameters that characterize malt quality. According to this act, the varietal trials are carried out by a state administration body, which is the Central Control and Testing Institute in Agriculture (CCTIA). The CCTIA carries out the state varietal trials for the purposes of registering new varieties, extending the registration of varieties already registered and providing documents for the grant of rights in respect of a variety. In the Slovak Republic, 2/3 of the registered propagation areas were sown with the spring barley varieties Overture, Kangoo, Tango and Laudis 550 ([Dráb et al., 2021](#)).

2 Material and methods

In the present study, the technological and agronomic characteristics of the Amidala, Ellinor and LG Belcanto spring barley malting varieties, which by harvest 2021 completed the state varietal tests, were assessed ([Table 1](#)).

The malting quality of Amidala, Ellinor and LG Belcanto was determined based on analyses of 12 malt samples obtained in 2019 to 2021.

The samples (0.5 kg) were malted in the micromalting equipment of the KVM company (CR). For micromalting, the method traditionally used in the Research Institute of Brewing and Malting, which is almost identical with the method described in [MEBAK \(2011\)](#), was applied. Grain fraction over 2.5 mm was malted.

Steeping was conducted in a steeping box. Water and air temperatures were kept at 14.0 °C. The length of steeping on the first day was 5 hours and on the second day it was 4 hours. On the third day, the water content in the germinating grains was adjusted to the value of 45% by steeping or spraying.

Germination was conducted in a germination box. The temperature during germination was kept at 14.0 °C. The total time of steeping and germination was 144 h.

Kilning was performed in a single floor electrically heated kiln. The total kilning time was 22 hours. Free-drying stage was performed at the temperature of 55 °C for 12 hours. During the forced drying stage, the temperature gradually rose over the course of six hours, to 75 °C. The curing stage at 80 °C took the last 4 hours.

The parameters listed in the Malting Quality Index (MQI) were determined in the malt produced (Psota and Kosař, 2002). Malt quality was determined according to the methods described in MEBAK (2011) and EBC Analysis Committee (2010). The methods used are listed in Table 2.

3 Results

The present study evaluates the spring barley varieties registered in the Slovak Republic after the harvest of 2021 (Table 2). The yield, resistance to diseases and other agronomic characteristics of the studied varieties are given in Table 3.

Amidala is a variety bred in Germany. At the optimal content of nitrogenous substances (10.7%) in non-malted grain, it gave satisfactory extract content (82.7%) and the optimal level of diastatic power (367 WK). The intensity of proteolytic modification was satisfactory (Kolbach index 49.4%), cytolytic modification was at the optimal level (friability 92%; β -glucan content in the wort 68 mg/l). The composition of wort was satisfactory (final attenuation 80.9%) and clear in most cases.

Amidala is an early spring barley variety. Its growing season (119 days) and time to heading (80 days) are similar to the control variety Soulmate. Amidala is a variety of a mid-high type (78 cm), medium resistant to lodging, the variety is well resistant to powdery mildew of barley (*Blumeria graminis*) and it is sensitive to the complex of leaf spots (*Pyrenophora teres*). Grain is big (TGW 46 g) and grain yield over 2.5 mm is 92%.

In the course of tests conducted between 2019–2021, Amidala achieved an above-average yield in all production areas. Compared to the average detected in the control varieties in the Slovak Republic, it achieved a yield of 7.48 t/ha, i. e. 111% (113%, 112%, 107% in the maize area, sugar-beet area and potato and mountain production areas, respectively) per average of the control varieties.

Table 1 Set of registered barley varieties after the harvest of 2021

Variety / Code	Agent in the SR / Maintainer
spring barley malting varieties	
Amidala	Rapool CZ s.r.o.
NORD16/2320	SAATEN-UNION GmbH
Ellinor	RWA SLOVAKIA, spol. s r. o.
Br12130d5	Saatzucht Josef Breun GmbH&Co. KG
LG Belcanto	Limagrain Central Europe Cereals, s.r.o.
LGBN 15018-36	Limagrain Europe

Amidala was registered in the Czech Republic with similar results (Psota et al., 2021). According to the EU Plant Variety Database (2022), the variety was also registered in Austria, Estonia, France, Germany, Hungary, Lithuania, Luxembourg and Poland.

Ellinor, the variety bred in Germany, gave, at the optimal content of nitrogenous substances (10.7%) in non-malted grain, malt with a good level of amylolytic modification. The level of the extract content was satisfactory (82.3%) and diastatic power optimal (329 WK). The intensity of proteolytic modification was optimal (Kolbach index 48.6%). Cell wall degradation was optimal (87%) and β -glucan in the wort was satisfactory (174 mg/l). The wort composition was optimal (apparent final attenuation 81.5%). In all cases, the variety provided clear wort.

Ellinor is an early spring barley variety. The growing season (119 days) and time to heading (80 days) are similar to the control variety Soulmate. The variety is of a mid-high type (78 cm), medium resistant to lodging, with good resistance to powdery mildew of barley (*Blumeria graminis*) and it is sensitive to the complex of leaf spots (*Pyrenophora teres*). Grain is medium big (TGW 42 g) and grain yield over 2.5 mm is 92%.

In the course of tests conducted between 2019–2021, Ellinor achieved an above-average yield in all production areas. Compared to the average detected in the control varieties in the Slovak Republic, it achieved a yield of 7.07 t/ha, i. e. 105% (104%, 104%, 106% in the maize area, sugar-beet area and potato and mountain production areas, respectively) per average of the control varieties.

According to the EU Plant Variety Database (2022), the variety Ellinor was registered in Austria, Estonia, Finland, France and Lithuania.

LG Belcanto is a variety bred in the Netherlands. At the optimal content of nitrogenous substances (10.6%) in non-malted grain, it gave an optimal level of amylolytic modification. Malt extract content was at the level of 82.8%, diastatic power 369 WK. The intensity of proteolytic modi-

Table 2 Spring barley grain and malt analyses

Methods	Unit	References	2019-2021						
			Odyssey C	Overture C	Soulmate C	Amidala	Ellinor	LG Belcanto	
Degree of steeping 1	%		$\bar{x} \pm s_x$ 32.6 ± 1.1	$\bar{x} \pm s_x$ 34.5 ± 1.3	$\bar{x} \pm s_x$ 33.7 ± 1.2	$\bar{x} \pm s_x$ 32.6 ± 1.1	$\bar{x} \pm s_x$ 34.0 ± 1.2	$\bar{x} \pm s_x$ 32.6 ± 1.3	
Degree of steeping 2	%		40.2 ± 1.2	42.3 ± 1.6	41.5 ± 1.3	40.1 ± 1.3	41.4 ± 1.2	40.1 ± 1.3	
Malt yield d. m.	%	Briggs 1998	91.2 ± 1.2	91.0 ± 1.3	91.0 ± 1.2	92.2 ± 1.2	91.0 ± 1.2	92.1 ± 0.9	
Respiration losses d. m.	%	Briggs 1998	4.6 ± 0.8	4.4 ± 0.7	4.3 ± 0.8	4.0 ± 0.8	4.5 ± 0.8	4.0 ± 0.6	
Rootlet losses d. m.	%	Briggs 1998	4.2 ± 0.5	4.6 ± 0.7	4.7 ± 0.5	3.9 ± 0.4	4.5 ± 0.6	3.9 ± 0.4	
Starch content of barley	%	NIR	63.4 ± 1.1	62.8 ± 1.3	63.0 ± 1.2	63.5 ± 1.2	63.3 ± 0.9	63.5 ± 0.9	
Protein content of barley (factor 6.25) d.m.	%	EBC 2010, 3.3.1	10.9 ± 0.7	10.9 ± 0.9	10.7 ± 0.9	10.7 ± 0.7	10.7 ± 0.8	10.6 ± 0.7	
Extract of malt, congress mash	%	EBC 2010, 4.5	82.1 ± 1.3	82.9 ± 1.5	83.3 ± 0.9	82.7 ± 1.1	82.3 ± 1.3	82.8 ± 1.1	
VZ 45 °C	%	MEBAK 2011, 4.1.4.11	42.2 ± 3.5	50.9 ± 4.2	45.4 ± 3.7	45.4 ± 3.6	48.5 ± 2.6	46.8 ± 3.1	
Kolbach index	%	EBC 2010, 4.9.1	44.4 ± 3.0	48.5 ± 2.7	49.7 ± 2.6	49.4 ± 2.7	48.6 ± 2.2	48.7 ± 1.8	
Diastatic power	WK	EBC 2010, 4.12	330 ± 39	368 ± 58	444 ± 69	349 ± 48	326 ± 42	342 ± 48	
Apparent final attenuation	%	EBC 2010, 4.11	81.4 ± 1.2	82.1 ± 0.8	82.2 ± 0.8	80.7 ± 0.6	81.7 ± 1.5	81.0 ± 0.8	
Friability	%	EBC 2010, 4.15	85 ± 4.1	88 ± 5.4	94 ± 3.4	93 ± 5.4	85 ± 5.8	91 ± 3.9	
β-glucan content of malt, SFA	mg/l	EBC 2010, 4.16.2	177 ± 57	129 ± 53	68 ± 38	74 ± 40	172 ± 55	174 ± 68	
Protein content of malt (factor 6.25)	%	EBC 2010	10.5 ± 0.7	10.6 ± 0.9	10.3 ± 0.9	10.4 ± 0.7	10.2 ± 0.8	10.1 ± 0.7	
Total nitrogen of malt, Kjeldahl method	%	EBC 2010	1.7 ± 0.1	1.7 ± 0.1	1.7 ± 0.1	1.7 ± 0.1	1.6 ± 0.1	1.6 ± 0.1	
Soluble nitrogen of wort, Kjeldahl method	mg/l	EBC 2010	836 ± 63	917 ± 87	918 ± 89	917 ± 83	891 ± 65	879 ± 72	
Soluble nitrogen of malt, Kjeldahl method	mg/100g	EBC 2010	747 ± 55	819 ± 77	821 ± 79	820 ± 73	796 ± 57	785 ± 63	
Appearance (clarity) of wort		MEBAK 2011, 3.1.4.2.6	1.0 ± 0.0	1.1 ± 0.3	1.1 ± 0.3	1.0 ± 0.0	1.0 ± 0.0	1.0 ± 0.0	
Haze of wort (90°)	EBC	EBC 2010	0.6 ± 0.2	0.9 ± 0.7	1.1 ± 1.0	0.9 ± 0.2	0.8 ± 0.3	0.9 ± 0.3	
Haze of wort (12°)	EBC	EBC 2010	0.7 ± 0.3	1.0 ± 0.9	1.2 ± 1.2	0.9 ± 0.4	0.9 ± 0.3	1.1 ± 0.6	

\bar{x} = mean
 s_x = sample standard deviation

C – control varieties
Wort clarity
1 = clear
2 = weakly opalizing
3 = opalizing
4 = cloudy

Table 3 Important agronomic characters

Variety	2019–2021						
	spring barley						
	Mean of the control varieties	Odyssey	Overture	Soulmate	Amidala	Ellinor	LG Belcanto
Grain yield	(t/ha)	C	C	C			
maize production area	6.88	6.93	6.65	6.76	7.80	7.16	7.71
sugar-beet production area	6.68	6.88	6.44	6.48	7.45	6.92	7.59
potato and mountain production areas	6.65	6.77	6.55	6.51	7.12	7.06	7.67
Grain yield mean of the test							
year 2019	6.82	6.54	6.06	6.02	7.10	6.64	7.66
year 2020	7.06	6.80	6.99	6.98	7.43	7.21	7.88
year 2021	7.05	7.08	6.59	6.68	7.65	7.17	7.52
Agronomical data							
straw length (cm)	78	78	79	73	78	80	79
earliness of ripening (day)	120	120	120	119	119	119	120
standing power (lodging resistance)	7.17	6.35	6.69	7.00	7.06	6.64	7.06
Resistance to diseases							
powdery mildew of barley (<i>Blumeria graminis</i>)	8.4	8.5	8.5	8.4	8.5	8.5	8.4
leaf brown rust of barley (<i>Puccinia hordei</i>)	8.1	8.1	8.1	8.0	8.1	8.2	7.9
complex of leaf spots (<i>Pyrenophora teres</i>)	6.1	6.3	6.3	5.6	6.1	6.1	6.1
scald of barley (<i>Rhynchosporium secalis</i>)	8.7	8.8	8.7	8.7	8.5	8.7	8.5
Mechanical properties (grain quality)							
1000 grain weight (g)	43	41	40	39	46	42	44
sieving fractions over 2.5 mm (%)	92	93	91	91	92	92	92
Comments:	C = control 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.							

fication was optimal (Kolbach index 48.7%). Cell wall degradation was also optimal (friability 90%) and β -glucan content in the wort at a satisfactory level (161 mg/l). The composition of wort was satisfactory (apparent final attenuation 81.3%). The variety provided clear wort in all cases.

LG Belcanto is a mid-early spring barley variety. The growing season (120 days) and time to heading (80 days) are similar to the control variety Soulmate. LG Belcanto is a variety of mid-high type (79 cm), with medium resistance to lodging. It is well resistant to powdery mildew of barley (*Blumeria graminis*) and sensitive to the complex of leaf spots (*Pyrenophora teres*). Grain is medium big (TGW 44 g) and grain yield over 2.5 mm is 92%.

In the course of tests conducted between 2019–2021, LG Belcanto achieved an above-average yield in all production areas. Compared to the average detected in the control varieties in the Slovak Republic, it achieved a yield of 7.68 t/ha, i. e. 114% (112%, 114%, 115% in the maize area, sugar-beet area and potato and mountain production areas, respectively) per the control varieties average.

LG Belcanto was registered in the Czech Republic with similar results (Psota et al., 2021). According to the EU Plant Variety Database (2022), the variety was also registered in France, Germany and Poland.

4 Conclusion

In 2019–2021, the micro-malting trials of the varieties of Amidala, Ellinor and LG Belcanto were carried out within the state varietal tests of the Slovak Republic. Grain of these varieties was collected from four CCTIA test sites each year. The malts showed acceptable to optimal extract content at the optimal cell wall solubility level of extract at the optimal content of nitrogenous substances content. The solubility of cell walls was optimal. The values of the relative extract at 45 °C and Kolbach index were optimal in most cases; the Ellinor variety reached the same values for these two traits. The diastatic power values were at the optimal level; this led to a satisfactory to optimal apparent final attenuation. On average, the worts had a satisfactory to optimal β -glucan content. The varieties of Ellinor and LG Belcanto gave clear malt in all cases.

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