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Assortment of varieties of malting barley in the Czech Republic in the year 2000

In this paper, results of micromalting and malt and wort analyses of 16 barley cultivars registered in the Czech Republic for the year 2000 are presented. This study is a continuation of the article published by *Psota* and *Kosar* (1996) and presents a survey of changes in the assortment of malting barley cultivars in the Czech Republic within the last four years.

BC 11 Barley

(Descriptors: Barley varieties, agrotechnical properties, malting quality index, malting properties.

Deskriptoren: Gerstensorten, landwirtschaftliche Eigenschaften, Malzqualitätsindex, Mälzungseigenschaften).

1 Introduction

In recent years, many of the changes were due to the new Act No. 92/1996 Sb. on seeds and planting materials. According to this Act, one of the preconditions of spring barley registration is to show that the new variety, as compared with other registered cultivars, represents at least in some of the important growing regions of the Czech Republic an apparent contribution to the present assortment either for its agrotechnical properties or its utilisation or derived products. Today, there are 57 varieties of spring and winter barley registered in the Czech Republic. Of these, 25 are of malting quality as given by malting quality index. This paper deals only with the most common and/or new varieties.

2 Micromalting

The grain used for micromalting originated from state trials established with certified seed material by the Central Institute for Supervising and Testing in Agriculture (CISTA). Grain samples of control varieties from all trials were tested for their protein content each year immediately after the harvest. Thereafter, the complete assortment of varieties was analysed from four localities where the control varieties had optimal protein content. This assured that the determined malting parameters were not negatively influenced by a low or on the contrary, an unfavourably high protein content.

2.1 Micromalting procedure

For micromalting trials, the grain portions above a 2.5-mm sieve were used (EBC 1999). Micromalting started in November after the end of post-harvest maturation in a micromalter KVM. The computer-controlled micromalter enabled to set and regulate the experimental conditions.

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The process of malting traditionally used at the Research Institute of Brewing and Malting was identical with that recommended by EBC with the only difference that the total malting time was reduced to 144 hours. Using this shorter malting time it was possible to establish more pronounced differences among the tested varieties. This system has been applied since 1960s and was very similar to the newly proposed EBC system.

2.2 Rating of varieties

In all tested varieties malting quality was followed on the base of protein content, extract, relative extract at 45 °C, Kolbach index, diastatic power, apparent final attenuation, friability and β-glucan content in wort). During the testing procedure, also some other malting parameters (e. g. viscosity, colour of wort, etc.) were followed. The malting parameters presented in this paper were estimated using the methods EBC (1998) and MEBAK (1979)

Agrotechnical properties of tested varieties are presented in Tabs 1 and 2.

3 Analysis of malt and wort

3.1 Spring barley – List of recommended varieties

Until 1995, there were only Czech and Slovak varieties in our assortment. In 1996, the variety Krona was registered as the first foreign variety of spring barley. Since that the share of foreign varieties in the assortment has been gradually increasing.

In Table 2 mean values of technological parameters under study are presented for the period 1996 – 1999. These mean values were obtained using 16 samples (i. e. within 4 years and from 4 localities).

As one can see in this table, the content of extract in the assortment was very good. There was no variety with an extract below 81.5% in this assortment. More than one third of the tested varieties showed extract values higher than 82.5%.

Varieties Kompakt, Nordus, Atribut, Krona and Olbram showed a very high activity of proteolytic enzymes. Other varieties showed medium values of protein modifications. A low or even negative difference between Kolbach index and relative extract at 45 °C represents a desirable property. This characteristic was pronounced at most in cultivars Akcent and Novum.

In the major part of the assortment the activity of β-amylase was very good in case that the protein content in barley grains was on the optimum level. The lowest, but still optimum value of diastatic power showed the variety Olbram (254 WK).

Table 1 Important agronomical Characters (1996 – 1999)

		SPRING BARLEY														WINTER BARLEY	
	100 % in t/ha	AKCENT	AMULET	ATRIBUT	FORUM	KOMPAKT	KRONA	MADEIRA	MADONNA*	MARIDOL	NORDUS*	NOVUM	OLBRAM	SCARLETT	TOLAR	100 % in t/ha	TIFFANY
Yield in the region:																	
Maize production region	7,01	99	99	97	104	92	99	L	105	L	100	99	92	97	102		L
Sugar beet production region	6,90	97	98	97	103	93	101	L	101	L	100	97	92	100	105		L
Cereal production region	5,76	96	98	97	102	89	101	L	101	L	103	97	94	102	107		L
Potato production region	5,53	96	95	96	102	93	101	L	101	L	101	96	94	103	104		L
Forage production region	5,86	92	98	100	98	92	105	L	104	L	102	95	92	101	103		L
Year of registration:		1992	1995	1996	1993	1995	1996	1999	1998	1999	1998	1988	1996	1997	1997		1999
Agronomic data:																	
Plant height		69	68	70	63	66	77	L	73	L	76	60	71	69	73		L
Maturity (days from Amulet)		0	0	0	+1	-1	+1	L	+1	L	+1	-1	-1	0	0		L
Lodging resistance (standing power)		7	8	6	7	5	6	L	6	L	7	6	5	4	6		L
Resistant to diseases								L		L							L
Blumeria (Erysiphe) graminis		5	3	9	9	4	9	L	7	L	9	5	8	6,5	5		L
Puccinia hordei		6	6	4	3	6	5	L	5	L	4	5	3	4,5	6		L
Pyrenophora teres		3,5	6,5	4	5	6	4	L	5	L	5	4	4	5	6,5		L
Rhynchosporium secalis		3,5	5	6	4	6	6	L	5	L	6	6	6	6	7		L
Thousand grain weight		46	49	48	44	46	45	L	46	L	46	45	43	45	47		L
Malting quality index**		6	6	7	8	9	8	L	7	L	9	7	8	8	6		6

(*) Limited data - newly ranged varieties.
(**) Value MQI rewarded in the year of the registariton
Relative values are in relation to average of all varieties in the given region.
L - The data are not present for the lack of information
Evaluation:
9 = A high figure indicates that a variety shows the character to a high degree (good standing power, resistant to diseases, the highest quality).
1 = A low figure indicates that a variety shows the character to a low degree (poor standing power, non resistant to diseases, non malting quality).
Weight of 1000 grains over 2.00 of humidity 14 %.
Malting quality assessment was carried out by the Research Institute of Malting and Brewing, Malting Institut Brno.
(N) The quality of non malting varieties was not further followed.

Table 2 Yield of grain over 2.5 mm and technological values of grain and malt (1996 – 199)

		SPRING BARLEY														WINTER BARLEY
	unit	AKCENT	AMULET	ATRIBUT	FORUM	KOMPAKT	KRONA	MADEIRA	MADONNA*	MARIDOL	NORDUS*	NOVUM	OLBRAM	SCARLETT	TOLAR	TIFFANY
Grain over 2,5 mm																
Maize production region	%	87	95	90	80	90	93	L	89	L	91	84	86	91	86	L
Sugar beet production region	%	87	95	90	81	90	91	L	92	L	93	87	86	93	90	L
Cereal production region	%	81	93	85	77	85	88	L	88	L	89	79	79	88	87	L
Potato production region	%	84	92	86	79	88	87	L	89	L	90	80	83	90	87	L
Forage production region	%	84	92	86	79	88	87	L	89	L	90	80	83	90	87	L
Grain:																
Protein content d.m.	%	10,8	10,9	11,3	10,4	10,5	11,0	10,8	10,5	11,1	11,0	10,8	11,1	10,4	10,8	10,8
Malt:																
Extract yield d.m.	%	81,7	82,4	82,4	82,6	82,9	82,3	82,8	82,2	82,2	83,2	82,0	82,7	83,3	82,1	82,2
Relaltive extract at 45 °C	%	45,0	37,9	45,4	39,4	46,9	42,2	41,3	39,5	37,4	43,9	45,0	42,9	44,1	37,9	40,9
Kolbach	%	45,4	45,8	48,9	46,3	49,8	47,4	46,6	46,7	43,7	49,8	46,2	47,3	46,9	43,8	48,0
Diastatic power	WK	325	332	303	353	316	337	340	320	239	305	285	254	293	393	315
Apparent final attenuation	%	82,2	81,7	80,2	83,1	82,1	83,1	83,0	82,8	79,7	81,6	81,7	82,1	82,5	82,3	83,1
Friability	%	77,7	78,0	78,1	85,0	86,3	81,3	81,5	85,1	83,3	88,8	78,3	83,9	78,2	83,6	79,7
β–glucan content in wort	mg/l	278	231	321	238	161	204	238	195	263	103	231	205	311	202	254

(*) Limited data - newly ranged varieties.
(N) The quality of non malting varieties was not followed.
L - The data are not present for the lack of information

The most marked differences among varieties under study were observed in the cytolytic modification. Altogether nine varieties showed friability over 80% and the absolutely lowest value of friability was not lower than 78%. Even greater were the differences in the activity of β-glucanase. Within the experimental group, there were two varieties (Kompakt and Nordus) with a high activity of this enzyme; this reflected a markedly low β-glucan content in wort (i. e.161 and 103 mg.l^{-1}, resp.). At the same time, these varieties showed also the highest values of friability. In another 4 varieties the β-glucan content in wort was approximately 200 mg.l^{-1}.

A high activity of the enzymatic apparatus in the set of varieties under study showed a positive effect on the values of apparent final attenuation. An exceptionally favourable composition of wort had the varieties Forum and Krona, followed by another six varieties with values of apparent final attenuation above 82%.

The assortment of varieties described in our earlier paper (*Psota, Kosař* 1996) and in this study was partially identical. When comparing both experimental sets one can observe a certain qualitative change which resulted from the progress in breeding work. New varieties show above all higher extract values. Also cytolytic modification has improved. A high activity of proteolytic enzymes remains to be a problem and it seems that in new varieties it is even more pronounced. Similar results are obtained also within the framework of EBC tests.

3.1.2 Characterization of individual varieties

- *Akcent* shows favourable content of extract, high proteolytic activity, low difference between values of RE 45 °C and Kolbach index, optimal level of apparent final attenuation and high diastatic power. Activity of cytolytic enzymes is low.
- *Amulet* is a variety with high content of extract, high proteolytic activity, big difference between RE 45 °C and Kolbach index, optimal level of attenuation, high diastatic power. Activity of cytolytic enzymes is lower.
- *Atribut* is a variety with high content of extract, high proteolytic and amylolytic activity, medium level of apparent final attenuation. Activity of cytolytic enzymes is a weak feature of this variety.
- *Forum* is a variety with rich content of extract and proteolytic activity approaching to the current requirements put on this parameter. The variety shows a greater difference between values of relative extract at 45 °C and Kolbach index. The diastatic power of this variety is high and the composition of wort optimal. The friability is also on optimal level but it does not correspond with a higher β-glucan content in the wort.
- *Kompakt* shows high content of extract, high activity of proteolytic, amylolytic and cytolytic enzymes and optimal degree of attenuation. This variety shows a low β-glucan content in wort.
- *Krona* is a variety with better-than-average content of extract in dry malt, high activity of protelytic and amylolytic enzymes and normal activity of cytolytic enzymes. The composition of wort is optimal.
- *Madeira* shows a high content of extract and a high activity of protelytic and amylolytic enzymes. Its friability values are on an average level but the content of β-glucans in wort is higher. The composition of wort is optimal.
- *Madonna* is a variety with a better-than-average content of extract and a high activity of protelytic and amylolytic enzymes. The activity of cytolytic enzymes is on an optimal level and the composition of wort is also outstanding.
- *Maridol* is a variety with a better-than-average content of extract. The value of proteolytic attenuation is approaching to the current requirements on this parameter. The diastatic power is subnormal and the composition of wort is moderate. The friability is at a very good level but does not correspond with the high β-glucan content in wort.
- *Novum* is a variety with favourable content of extract, high proteolytic attenuation, minimal difference between values of relative extract at 45 °C and Kolbach index. Amylolytic attenuation is also high. The composition of wort is optimal. Cytolytic attenuation is weak.
- *Nordus* shows a high content of extract and a high activity of all groups of enzymes under study including the cytolytic ones. The content of β-glucans in wort is very low. A high enzymatic activity influences favourably the composition of wort.
- *Olbram* is a variety with rich content of extract, high proteolytic, average amylolytic and favourable cytolytic activity. The composition of wort is on an outstanding level due to a very good enzymatic activity.
- *Scarlett* is a variety with rich content of extract, high activities of proteolytic and amylolytic enzymes and optimal composition of wort. Cytolytic attenuation represents a weak feature of this variety.
- *Tolar* is a variety with a better-than-average content of extract. The value of proteolytic attenuation of this variety is approaching to the current requirements put on this parameter. Amylolytic attenuation is at an outstanding level and also the cytolytic attenuation is very good. High enzymatic activity influences positively the optimal composition of wort.

3.2 Spring barley – a variety registered in the year 2000

In the year 2000 only the variety Jersey was registered in the Czech Republic. The obtained results are presented in a paper published by *Psota, Jurečka* (2000).

3.2.1 Characteristics of the variety

Jersey: the content of extract in malt is high. The activity of proteolytic enzymes is very pronounced. Activity of cytolytic enzymes is also high and the values of friability were oscillating around 90%. The variety showed a favourable β-glucan content in wort (175 $mg.l^{-1}$). Diastatic power of β-amylase was on an optimal level. The variety can produce wort with an optimal composition.

3.3 Winter barley

Despite of the fact that in the Czech Republic malt is traditionally produced from spring barley, the malting quality of winter barley varieties has also been tested every year within the framework of the registration procedure. The requirements put on the malting quality of these varieties are the same as those put on spring barley cultivars. A number of foreign varieties of malting winter barley, as tested in the framework of the registration procedure, did not show their malting quality under conditions of the Czech Republic. For that reason, these varieties were either not registered at all or they were registered only as non-malting ones.

Only in the year 1999 the variety Tiffany was registered as a malting one. Yet for the present time the malt producers in the Czech Republic, owing to the tradition and with regard to years that were more favourable for the spring barley, were not interested in growing of this variety.

3.3.1 Characteristics of the variety

Tiffany: the content of extract in malt is high, activity of proteolytic and amylolytic enzymes as well, and composition of wort is optimal. The weakest feature of this variety is cytolytic attenuation; however the friability value is on an acceptable level. The glucan content in wort markedly fluctuated in individual years (from values lower than 200 $mg.l^{-1}$ up to values of 300 $mg.l^{-1}$).

4 Summary

Within the period of 1992 – 1996, the assortment of 16 varieties of spring and winter barley with malting quality registered at present in the Czech Republic was evaluated. The varieties Forum, Kompakt, Madeira, Nordus, Olbram and Scarlett showed high contents of extract in the dry malt (over 82.5%). A majority of spring barley varieties under study showed a strong proteolytic attenuation. The only exceptions were the varieties Maridol and

Tolar and their proteolytic enzyme activities approached to the current requirements put on this parameter. The varieties Novum and Akcent showed little differences between values of relative extract at 45 °C and Kolbach index. The activity of amylolytic enzymes was on average and/or optimal level in all varieties under study. The same concerns also the composition of wort. The cytolytic attenuation was a weak feature in the majority of varieties investigated. Very favourable values of the β-glucan content in wort had the varieties Kompakt and Nordus, followed by the varieties Krona, Madonna, Olbram and Tolar.

The spring barley variety Jersey, registered in the year 2000, showed an outstanding malting quality.

The variety Tiffany had superb content of extract in dry malt, high proteolytic and amylolytic attenuation. Nevertheless it showed a higher content of β-glucans in wort.

New varieties showed especially a higher extract and a better cytolytic attenuation. A strong activity of proteolytic enzymes remains to be a problem.

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5 Zusammenfassung

Psota, V., Kosař, K., und Jurečka, D.: Braugerstensorten in der Tschechischen Republik im Jahr 2000 — Monatsschrift für Brauwissenschaft 54, Nr. 1/2, 9 – 12, 2001

BC 11 Gerste

Im Zeitraum von 1992 bis 1996 wurde das gegenwärtig in der Tschechischen Republik registrierte Sortiment aus 16 Sorten Sommer- und Wintergerste mit Mälzereiqualität ausgewertet. Die Sorten Forum, Kompakt, Madeira, Nordus, Olbram und Scarlett wiesen höhere Extraktanteile im lufttrockenen Malz auf (über 82,5%). Eine Mehrheit der untersuchten Sommergerstensorten wies eine starke proteolytische Aktivität auf. Die einzigen Ausnahmen bildeten die Sorten Maridol und Tolar, deren proteolytische Enzymaktivitäten sich den an diesen Parameter gestellten Anforderungen annäherten. Die Sorten Novum und Akcent wiesen geringe Unterschiede zwischen den Werten der jeweiligen Extrakte bei 45 °C und dem Kolbach-Index auf. Die Aktivität der amylolytischen Enzyme war bei allen untersuchten Sorten durchschnittlich und/oder auf optimalem Niveau. Dasselbe gilt auch für die Zusammensetzung der Bierwürze. Die cytolytische Aktivität war bei der Mehrheit der untersuchten Sorten schwach ausgeprägt. Sehr günstige Werte des Gehalts an β-Glucan in der Bierwürze hatten die Sorten Kompakt und Nordus, gefolgt von den Sorten Krona, Madonna, Olbram und Tolar. Die Sorte Tiffany hatte einen hervorragenden Gehalt an Extrakt im Trockenmalz sowie eine starke proteolytische und amylolytische Aktivität. Dennoch wies sie einen höheren Gehalt an β-Glucan in der Bierwürze auf. Neue Sorten wiesen insbesondere einen höheren Extraktanteil und eine bessere cytolytische Aktivität auf. Eine starke Aktivität proteolytischer Enzyme bleibt weiterhin ein Problem.

Psota, V., Kosař, K., et Jurečka, D.: Variétés d'orges brassicoles dans la République Tchèque en l'an 2000 — Monatsschrift für Brauwissenschaft 54, No. 1/2, 9 – 12, 2001

BC 11 Orge

On a exploité de 1992 à 1996 la qualité de maltage de l'assortiment de 16 variétés d'orges de printemps et d'hiver enregistrées actuellement dans la République Tchèque. Les variétés Forum, Kompakt, Madeira, Nordus, Olbram et Scarlett présentaient des extraits élevés dans le malt sur matière humide (supérieur à 82,5%). Une majorité des orges de printemps examinée présentait une forte activité protéolytique. Les seules exceptions étaient les variétés Maridol et Tolar qui avaient une activité enzymatique protéolytique s'approchant des exigences de ce paramètre. Les variétés Novum et Akcent présentaient de faibles différences entre les valeurs des extraits à 45 °C et l'indice Kolbach. L'activité des enzymes amylolytiques était pour toutes les variétés examinées en moyenne et/ou au niveau optimum. Ceci est également le cas pour la composition du moût de bière. L'activité cytolytique était faiblement prononcée pour la majorité des variétés examinées. Les variétés Kompakt et Nordus suivies des variétés Kroma, Madonna, Olbram et Tolar possédaient des valeurs très favorables au niveau de la teneur en béta-glucanes dans le moût de bière. La variété Tiffany avait une excellente teneur en extrait sur le malt sec ainsi qu'une forte activité protéolytique et amylolytique. Cependant elle présentait une teneur plus élevée en béta-glucanes dans le moût de bière. De nouvelles variétés présentaient en particulier une teneur en extrait plus élevée et une meilleure activité cytolytique. Une activité protéolytique forte pose toujours un problème.

6 References

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