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Technological quality of minor wheat species from organic farming and possibilities of their us

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Collection of spring form of spelt wheat, emmer wheat and einkorn wheat genetic resources from the Gene Bank of CRI Prague-Ruzyně, cultivated in exact field small-plot trials under organic farming conditions of three experimental localities (Prague-Ruzyně, Prague-Uhříněves and České Budějovice) was evaluated with the view of basic technological parameters. Two spring cultivars of common wheat – SW Kadrilj and Jara as a check varieties were used. Minor wheat species were in comparison with the check cultivars of common wheat characterized by higher crude protein content and wet gluten content in grain dry matter. Gluten Index and Zeleny test values were low in einkorn and emmer, but in spelt were higher - this indicates wider possibilities of the spelt use for different types of bakery products.

Keywords: spelt wheat, einkorn wheat, emmer wheat, organic farming, technological quality

1 Introduction

Hulled wheat species belong to the neglected crops. However, they have the potential to be used by the food industry. Einkorn is the oldest of domesticated wheat species. Emmer wheat used to be one of the most significant crops for almost 7,000 years. Spelt wheat is called an obsolete European wheat. As the organic farming has developed, the hulled wheat species have become more attractive and have been used more in Europe (Konvalina et al., 2014).

Collection of wheat genetic resources in the Gene Bank of Crop Research Institute Prague-Ruzyně is the largest from all collections of plant genetic resources in the Czech Republic. Collected samples are evaluated in view of production parameters as well as quality. On the basis of these information it is possible to choose materials, suitable for use in breeding or in agricultural practice (Stehno, 2005).

2 Material and Methods

Collection of spring form of spelt, emmer an einkorn genetic resources was obtained from the Gene Bank of CRI Prague-Ruzyně (Tab. 1) a cultivated during 2011–2013 in exact field small-plot trials under organic farming conditions of three experimental localities: Prague-Uhříněves (295 m above sea level, average year temperature 8.3 °C, sum of precipitation 575 mm), Prague-Ruzyně (340 m above sea level, average year temperature 7.8 °C, sum of precipitation 472 mm) and České Budějovice (388 m above sea level, average year temperature 8.0 °C, sum of precipitation 620 mm). Two spring common wheat cultivars – present SW Kadrilj and older Jara were used as a check cultivars.

Grain samples for quality evaluation were taken after the field trials harvest. Within the frame of the baking quality, crude protein content according to the Kjeldahl method (EN ISO 20483; ICC-Standard No. 105/2), wet gluten content in grain dry matter and Gluten Index using the

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apparatus Glutomatic Perten (ISO 5531), falling number (ISO 3093) and sedimentation index – Zeleny test (ISO 5529) were determined.

Table 1 Evaluated genetic resources

Einkorn wheat	Emmer wheat	Spelt wheat
T. monococcum (GEO)	Rudico (CZE)	*T. spelta* Ruzyně (CSK)
T. monococcum (ALB)	May-Emmer (CHE)	*T. spelta* Tabor 1 (CSK)
Schwedisches Einkorn (SWE)	*T. dicoccon* Tapioszele (HUN)	*T. spelta* Tabor 2 (CSK)
T. monococcum No. 8910 (DNK)	*T. dicoccon* Dagestan (RUS)	*T. spelta* VIR St. Petersburg (CSK)
	T. dicoccon Palestine (ISR)	*T. spelta* Bílá jarní (CSK)
	Weisser Sommer (DEU)	*T. spelta* Kew (GBR)
	T. dicoccon Brno (CSK)	*T. spelta* No. 8930 (DNK)
	T. dicoccon Tabor (CSK)	

3 Results

It is evident from the results (Tab. 2), that evaluated minor wheat species exceeded check cultivars of common wheat in crude protein content and wet gluten content in grain dry matter substantially These results are in accordance with findings of many authors, for example Michalová et al. (2003).

Zeleny sedimentation and Gluten Index indicate baking quality of gluten. Evaluated minor wheat species, especially einkorn and emmer, reached considerably lower values of these parameters than check cultivars of common wheat. Low values of Zeleny sedimentation and Gluten Index indicate lower suitability of einkorn and emmer for production of leavened bakery products (Konvalina et al., 2008). But, they are very suitable for production of many kinds of non-leavened products (Marconi and Cubadda, 2005).

Table 2 Technological quality parameters of evaluated wheat species (average of 2011-2013 and standard deviation)

Locality	Crude protein content in grain DM (%)	Wet gluten content in grain DM (%)	Gluten Index (%)	Zeleny test (ml)	Falling number (s)
Einkorn wheat					
Praha-Uhříněves	17.49 ±2.03	41.82 ±9.02	9.45 ±5.41	18.22 ±8.51	282.92 ±73.37
Praha-Ruzyně	16.11 ±2.22	40.12 ±9.08	7.52 ±3.65	11.95 ±7.08	302.08 ±48.41
Č. Budějovice	15.62 ±2.67	39.65 ±7.75	8.16 ±3.75	12.22 ±6.48	315.75 ±42.18
Emmer wheat					
Praha-Uhříněves	17.72 ±2.35	42.51 ±8.16	14.11 ±7.62	15.72 ±5.56	253.41 ±38.51
Praha-Ruzyně	15.48 ±2.13	38.62 ±7.15	13.11 ±6.96	14.74 ±5.73	248.17 ±36.51
Č. Budějovice	17.21 ±2.15	40.92 ±6.42	12.42 ±7.41	12.35 ±3.08	276.82 ±42.11
Spelt wheat					
Praha-Uhříněves	16.64 ±2.08	43.22 ±7.99	49.78 ±9.82	35.45 ±7.11	342.15 ±44.31
Praha-Ruzyně	14.85 ±1.88	39.12 ±6.76	38.06 ±5.02	33.06 ±6.65	315.15 ±35.36
Č. Budějovice	16.15 ±1.98	42.11 ±7.25	42.17 ±8.72	31.04 ±6.45	303.62 ±38.14
Common wheat – check cultivars					
Praha-Uhříněves	12.25 ±1.51	28.82 ±5.32	72.35 ±17.13	44.18 ±2.35	289.15 ±18.16
Praha-Ruzyně	11.51 ±1.28	25.46 ±4.02	62.15 ±12.18	40.49 ±2.70	276.35 ±20.15
Č. Budějovice	11.72 ±1.39	26.85 ±3.35	66.82 ±0.21	42.65 ±2.46	293.32 ±12.26

Spelt wheat reached in comparison with einkorn and emmer higher values of Zeleny sedimentation and Gluten Index and it is possible to say, that spelt utilisation will be wider - not only for production of non-leavened products, but also for leavened ones.

Falling number reached very high values in all evaluated wheat species.

But, besides quality evaluation it is also necessary to take into consideration production ability of evaluated minor wheat species. Grain yields of the check cultivars of common wheat reached in our experiments about 5.5 t ha^{-1}. Spring spelt wheat reached in average about 60–70 % of the check cultivars yield, emmer in average about 50–55 % and einkorn about 40 % of the check cultivars yield.

4 Conclusions

Evaluated minor wheat species were able to keep even in conditions of organic farming, without use of industrial nitrogen fertilizers, their specific character of quality parameters, especially high crude protein content in grain dry matter. Einkorn and emmer will be suitable (due to low values of Zeleny sedimentation) especially for production of non-leavened products (whole-meal products, müesli, cereal breakfasts etc.). Spelt is characterized with higher breadmaking quality and its utilization is wider – even for production of leavened dough.

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