

THE SIGNIFICANCE OF SPELT WHEAT CULTIVATED IN ECOLOGICAL FARMING IN THE SLOVAK REPUBLIC

Význam pestovania pšenice špaldovej v ekologickom systéme hospodárenia na Slovensku

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Summary: Production parameters, technological and nutritional quality of five spelt varieties (Bauländer Spelz, Schwabenkorn, Holstenkorn, Rouquin, and Franckenkorn) cultivated in organic farming in the south region of the Slovak Republic were evaluated. Rouquin variety was characterized by the highest yield and the best technological quality, other spelt varieties had gluten of lower quality. The lowest yield was detected in Schwabenkorn variety of lower quality. The nutritional value of spelt wheat was defined by high content of fibre and sugars. According to achieved results, spelt wheat varieties are most suitable for cultivation in organic farming and for preparation of special cereal products, biscuits, cakes and for the preparation of mixtures with common wheat. High nutritional quality indicated spelt for use in the rational and special diets.

Key words: *spelt varieties, yield, gluten, technological quality, nutritional quality*

Súhrn: V južnej časti SR boli ekologickým spôsobom hospodárenia pestované odrody pšenice špaldovej (Bauländer Spelz, Schwabenkorn, Holstenkorn, Rouquin, Franckenkorn). U všetkých uvedených odrôd boli hodnotené produkčné parametre, technologická a nutričná kvalita. Odroda Rouquin sa vyznačovala najvyššou úrodou a technologickou kvalitou. Najnižšia úroda bola dosiahnutá u odrody Schwabenkorn, ktorej lepok bol nižšej kvality. Nutričná hodnota pšenice špaldovej bola charakterizovaná vysokým obsahom vlákniny a celkových cukrov. Na základe dosiahnutých výsledkov sú uvedené odrody pšenice špaldovej vhodné na pestovanie v ekologickom poľnohospodárstve a na výrobu špeciálnych cereálnych výrobkov.

KLúčové slová: *odrody pšenice špaldovej, úroda, lepok, technologická kvalita, nutričná kvalita*

Introduction

The cultivation of alternative crops supports biodiversity, economic growth, the utilization of marginal areas of ecological farms and also increases the nutritional quality of organic products. Spelt wheat (*Triticum spelta* L.) is low-input alternative crop, in which cultivation it is not necessary to use fertilisers and other chemical agents. High portion of glumes which keep grains in the spikelet strongly avoid pests, pathogens and disease to penetrate inside the grain (Kema *et al.*, 1992). The nutritional quality of spelt wheat

is high. Bonafaccia *et al.* (2000) shows the higher content of proteins and soluble fibre (correct the glycaemia) in spelt wheat than in common wheat. Those nutritional components could decrease the prevalence of cancer, cardio-vascular diseases and diabetes.

The aim of this study was to define the production parameters, to evaluate content and quality of wet gluten and to evaluate the content of basic nutrients in spelt wheat.

Materials and Methods

The experimental base of the Faculty of Agrobioloy and Food Resources, Slovak Agricultural University in Nitra is situated at Dolná Malanta. Dolná Malanta belongs to warm agroclimatic region, arid subregion and to distinct of predominantly mild winter. Average air temperature is 16,4°C and average annual precipitation is 532,5 mm.

Five spelt varieties - Bauländer Spelz, Holstenkorn, Franckenkorn, Schwabenkorn and Rouquin- were used in our experiment. The field trial was realised during two vegetative periods (2004 a 2005) and was ordered into five independent blocks in three repetitions. The average plot size was 30 m² and the overall land area was 450 m². The soil cultivation was realized at the experimental plots in order to create the

suitable conditions for sowing and the following growth of the spelt wheat. Spelt wheat was cultivated in ecological system without fertilization.

Production parameters (yield, number of productive tillers, number of grains per m², weight of thousand grains, the portion of glumes) were evaluated in three repetitions. The quality parameters were determined after dehulling of samples and evaluated according to valid standards. There were evaluated the content of wet gluten in %, Gluten index in %, extensibility in cm, swelling in ml, Zeleny test in ml, proteins, starch, fibre, sugars and fat.

The achieved results were statistically analysed by using the ANOVA, LSD test and correlation.

Results

Results of a two-year evaluation of production parameters are shown in table 1. The differences between spelt varieties were not significant. The highest yield (7.21 t.ha⁻¹) was detected in variety with intermediate number of productive tillers and grains per m² - Rouquin. The lowest yield was detected in Schwabenkorn variety, which was originated by selection of old spelt varieties. This variety was characterised by almost the lowest number of grains per m² and significant the lowest TGW. The portion of glumes high negative correlated with the yield ($r=-0.64^{++}$).

The basic parameter of technological quality of wheat is the wet gluten. Minimal content of wet gluten of elite (E) wheat quality is 27 % according to STN 46 1100-2. The content of wet gluten of spelt wheat was from 31.01 to 39.50 %. Rouquin variety which is the crossbreed of *Triticum spelta* and *Triticum aestivum* was characterised by the highest quality as compared to other spelt varieties. It could be predicted that the *Triticum aestivum* L. genome influenced the quality of this variety (tab. 2). Franckenkorn variety contains 1/6 of *Triticum aestivum* genome, which indirectly influenced the lower content of proteins; but the genome of spelt wheat is characterised by high content of wet gluten of very low quality. The content of proteins and wet gluten of typical

spelt wheat variety (Schwabenkorn) were significant the highest but the gluten quality was lower. However, there is a relationship between Holstenkorn and Bauländer Spelz (one of the parents of Holstenkorn) the content and quality of wet gluten was different in both varieties. On the basis of correlation analysis, we can predict that the higher was the content of proteins and wet gluten the lower was the gluten quality.

The average content of proteins was 16.3 % (tab. 3), the highest was in Schwabenkorn (18.55 %). Bonafaccia *et al.* (2000) shows high content of proteins and fibre (do 2 %). Moudrý and Dvořáček (1997) compared chemical composition of spelt wheat grain with grain of *Triticum aestivum* and they found out that higher content of proteins, fibre a minerals is influenced by genotype. Fibre prebiotic influence on the gastrointestinal tract, decrease the pH a increase the absorption of minerals. The highest content of fibre was detected in Bauländer Spelz. The content of starch was more than 60% in all varieties (tab. 3), similarly Abdel *et al.* (1995) shows higher content of starch (60.9-65.8 %). Protein-saccharine complex forms the dough structure and is the main source of sugars which are important for baking applications. From the nutritional point of view is starch rich source of energy and influence the level of glycaemia.

Table 1: Productive parameters of spelt wheat (2004-2005) (Produkční parametry pšenice špaldy)

Variety	Number of productive tillers per m ² (pc)	Number of grains per m ² (pc)	TGW (g)	Yield (t.ha ⁻¹)	Portion of glumes (%)
Holstenkorn	476 a	12289 a	52.67 b	6.04 a	29.94 ab
Franckenkorn	503 a	13175 a	54.58 b	6.74 a	27.84 ab
Rouquin	531 a	12274 a	53.90 b	7.21 a	27.04 a
Schwabenkorn	510 a	11146 a	47.97 a	5.85 a	30.03 ab
Bauländer Spelz	551 a	10812 a	52.83 b	6.30 a	30.72 b

Table 2: The content and quality of wet gluten of spelt wheat (Obsah a kvalita mokrého lepku u pšenice špaldy)

Variety	Wet gluten (%)	Gluten Index (%)	Extensibility (cm)	Zeleny test (ml)	Swelling (ml)
Bauländer Spelz	39.03 cd	45.89 b	15.66 b	32.33 c	8.67 b
Holstenkorn	35.37 b	48.73 c	15.66 b	26.67 a	9.33 b
Franckenkorn	38.73 c	43.57 a	13.00 a	32.33 c	6.33 a
Rouquin	31.03 a	64.67 d	13.66 ab	30.33 b	8.67 b
Schwabenkorn	39.50 d	44.83 ab	14.66 ab	35.33 d	7.33 a
average	36.55	49.54	14.53	31.40	8.07

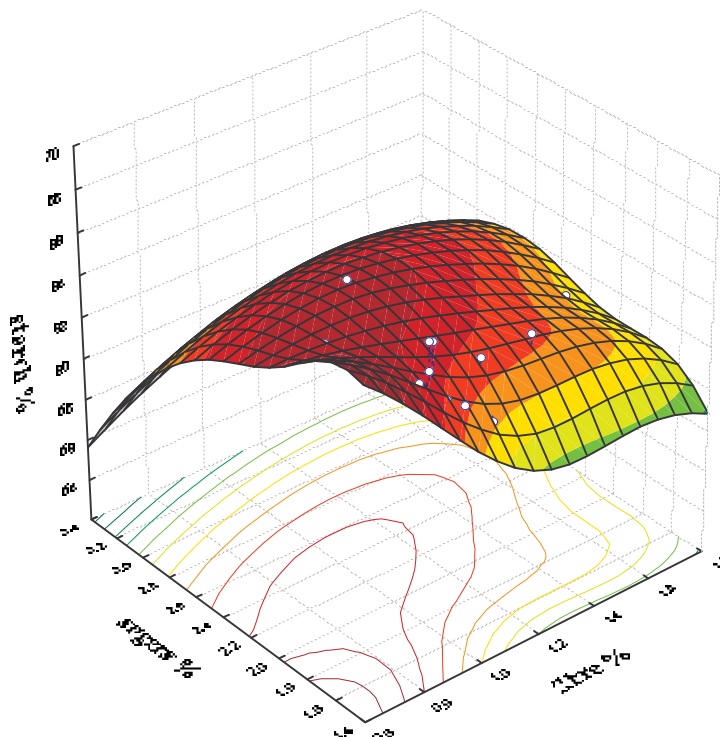
Table 3: Nutritional composition of spelt wheat (Nutriční složení pšenice špaldy)

Variety	Fat (%)	Fibre (%)	Sugars (%)	Starch (%)	Proteins (%)
Bauländer Spelz	2.07 a	1.40 b	2.81 b	61.31 a	17.55 c
Schwabenkorn	2.19 a	1.12 ab	1.72 a	63.12 ab	18.55 d
Holstenkorn	2.58 b	0.95 a	1.82 a	64.60 b	15.62 b
Franckenkorn	2.36 ab	1.28 ab	2.05 ab	63.06 ab	14.88 a
Rouquin	2.03 a	0.94 a	1.68 a	65.25 b	14.80 a
Priemer	2.25	1.14	2.02	63.47	16.28

Fat is important part of bakery and nutrition. Lacko-Bartošová *et al.* (2001) shows more than 2 % of fat, what was confirmed with our analyses too. The highest content of fat was in Holstenkorn, which was defined by almost the lowest content of fibre, sugars and

proteins. Bauländer Spelz variety contained most fibre, sugars but least starch. Correlation confirmed that the higher was the content of fibre and sugars; the lower was content of starch (graph 1).

Graph 1: Correlation between the content of fibre, sugars and starch



Conclusion

According to achieved results, the cultivation conditions were most suitable for Rouquin variety. That variety was characterised by the highest yield, the highest quality of wet gluten and favourable nutritional composition. Genetically pure varieties of spelt wheat, (without *Triticum aestivum* L. genome) were characterised by lower yields, high content of wet gluten

of lower quality. Those varieties were typical with the highest portion of proteins, fibre and sugars. On the basis of scientific literature and realised analysis it could be said that all evaluated varieties are suitable for cultivation in ecological farming and for the production of special cereal products.

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