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TECHNOLOGICAL VALUE OF A SPELT AND COMMON WHEAT HYBRID

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ABSTRACT

The grain of spelt (*Triticum spelta*) is distinguished by higher total protein contents (13 – 17%) as well as by the different composition of prolamine proteins compared to common wheat *(Triticum aestivum*). The breeders have again taken an interest in spelt because of its better resistance to the influence of the environment. Research material used was the grain of 16 hybrids of *(Triticum spelta* × *Triticum aestivum*), which was compared with spelt and the two varieties of the common wheat featuring diverse technological value – the Begra and the Elena. Evaluation of quality included grain, flour and bread. All hybrids featured less total protein contents than spelt, however, higher than in case of the common wheat. Better total yield of flour was obtained for the hybrids than that from the spelt. Volume of the hybrid bread was in between the spelt and the common wheat breads. Technological features and good taste of bread the hybrids STH 586, STH 588 and STH 594 mentioned above may be sucessfully used for commercial baking.

Key words: baking properties, milling properties, spelt and common wheat hybrid

INTRODUCTION

Spelt (*Triticum spelta*) displays many similar features to the common wheat *(Triticum aestivum)*, however, also many significant differences. Its grain is distinguished by higher total protein contents (13 – 17%) as well as by the different composition of prolamine proteins [4, 8]. This is probably why some people suffering from the food allergy tolerate products originating from spelt. Poor threshability of spelt as well as its lower crops (about 20%) as compared to wheat, have resulted in the reduction of its cultivation. For a couple of years, the breeders have

again taken an interest in spelt because of its better resistance to the influence of the environment [4]. Therefore, spelt is suitable as a base for crossing with common wheat in order to obtain hybrids featuring improved utility values.

The aim of this work was to compare the technological value of the obtained hybrids *(Triticum spelta* × *Triticum aestivum*) of spelt type, with spelt and the common wheat.

MATERIALS AND METHODS

Research material used was the grain of 16 hybrids of spelt and common wheat, which was compared with spelt and the two other varieties of the common wheat featuring diverse technological value – the Begra and the Elena. Evaluation of the grain included:

- hardness determined by means of the Brabender farinograph attachment [5],
- total protein contents determined on the Kjel-Foss Automatic (Nx5,83),
- the Hagberg falling number (ICC Standard no. 107).

The grain was ground in the Brabender Quadrumat Senior laboratory mill and the obtained break and reduction flours were mixed together to asses total yield of flour.
Flour baking quality was determined through the following analyses:

- Zeleny test [5],
- quantity and quality of wet gluten in the Glutomatic 2200 (ICC Standard no. 137)
- farinogram made in the Brabender farinograph-resistograph equipped with a computer attachment for data output (ICC Standard no. 115/1).

Laboratory baking was made using the single-phase wheat method. The bread produced was subjected to organoleptic assessment and the baking loss, yield of bread and its volume as well as porosity of the crumb were determined [5].

RESULTS AND DISCUSSION

Grain hardness, and that of the endosperm in particular, is one of the most important indicators of structural-mechanical properties of grain. This feature defines potential behaviour of the grain during milling. The hybrids under test, excluding three strains, were characterised by a grain of higher hardness than spelt and the variety of the Elena wheat (tab.1). However, only three hybrids featured hardness comparable with that of the variety of Begra wheat – having the grain distinguished by good and stable milling properties [7, 9]. All hybrids featured less total protein contents than spelt by approx. 10 – 25%, however, higher than in case of the common wheat. As regards the STH 602 hybrid, protein contents was higher by 23% in relation to the Begra variety and as much as 47% higher as compared with the Elena variety. Achremowicz et al. [1] and Grela et al. [3] obtained lower total protein contents in grain of spelt than that in the wheat grain. Grain of most of the hybrids was characterized by medium amylolithic activity. Like spelt and the common wheat variety, 6 hybrids have shown low activity figures (falling number exceeding 300 s). Low activity of the varieties of spelt have been also reported by Achremowicz et al. [1]. More break than reduction flour was obtained from the hybrids as well as from spelt and the common wheat varieties (tab. 2). As regards 6 hybrids, twice bigger amount of the break flour than that of reduction flour was obtained. Better total yield of flour was obtained for the hybrids (with the exception of three strains) than that from the spelt and the Elena variety. Higher total yield of flour than that of the Begra variety – by at least 1% - was obtained in case of 4 hybrids. Achremowicz et al. [1] found that flour made of spelt has better yield than the wheat flour. Higher Zeleny test result for the flour results from higher contents of the gluten protein – determining good baking quality (tab. 3). All hybrids featured better baking quality than spelt. Among them, only five hybrids featured higher Zeleny test result or equal to that for the Begra wheat variety – considered as being a wheat belonging to the quality class A according to COBORU [2]. None of the hybrids obtained came up to spelt as regards gluten contents. However, all the hybrids featured higher gluten contents – by at least 2% - than the Begra wheat variety. Quality of the gluten extracted from the hybrid flour and from the common wheat varieties alike – defined by the gluten index amounting to 6–91 and 2 to 73 respectively – showed considerable diversity. The dough made of a flour obtained from five hybrids featured long stability time and not large dough softening – similar to that of the Berga wheat variety (tab. 4). The smell of bread produced from the hybrid was pleasant, like that of the bread made of spelt and common wheat varieties. Spelt bread featured weakly perceptible nut taste that disappeared in case of the hybrid bread. As a rule, volume of the hybrid bread was in between the spelt and the common wheat breads (tab. 5). Differences in the hybrid bread volumes reached as much as 45%. Well risen loafs, featuring uniform and fine porosity were

obtained from the hybrids with strong gluten and good dough rheology properties. Yield of bread made of majority of the hybrids was better than that of the spelt bread and the common wheat varieties. Difference in yield of bread made of the hybrid was 10% while baking loss was 5.4%.

Table 1. Quality grains of spelt and common wheat hybrids

No.	Hybrid/variety	Hardness B.u.	Protein total %	Falling numbers
1	STH 569	280	14.5	345
2	STH 570	330	15.1	215
3	STH 576	340	15.0	263
4	STH 579	395	15.0	281
5	STH 586	460	15.3	280
6	STH 588	365	14.9	326
7	STH 563	310	16.4	297
8	STH 593	390	16.4	238
9	STH 594	430	16.2	274
10	STH 565	355	14.5	300
11	STH 561	325	14.6	327
12	STH 562	330	16.5	243
13	STH 599	230	15.5	336
14	STH 600	320	15.4	342
15	STH 602	310	17.3	270
16	STH 996	425	14.3	335
$LSD_{0.05}$		20	0.4	13
Spelt		290	19.2	325
Wheat - Begra		440	14.1	306
Wheat - Elena		310	11.8	348

Table 2. Milling properties of grain of spelt and common wheat hybrids

No.	Hybrid/variety	Break flour %	Reduction flour %	Yield of flour %
1	STH 569	45.6	29.6	75.2
2	STH 570	42.6	29.0	71.6
3	STH 576	47.6	24.9	72.5
4	STH 579	51.0	25.6	76.6
5	STH 586	46.0	27.9	73.9
6	STH 588	42.9	31.4	74.3
7	STH 563	41.4	24.4	65.8
8	STH 593	40.4	35.7	76.2
9	STH 594	43.5	31.2	74.6
10	STH 565	43.8	21.2	65.0
11	STH 561	44.0	30.8	74.9
12	STH 562	41.7	34.2	75.9
13	STH 599	47.7	20.5	68.1
14	STH 600	44.0	27.1	71.1
15	STH 602	47.4	21.9	69.3
16	STH 996	49.6	22.8	72.4
Spelt		48.7	19.2	67.9
Wheat – Begra		39.3	34.6	73.9
Wheat - Elena		41.8	26.7	68.5

Table 3. Quality flour of spelt and common wheat hybrids

No.	Hybrid/variety	Zeleny test cm^3	Wet gluten %	Gluten index
1	STH 569	24	37.1	6
2	STH 570	34	35.6	35
3	STH 576	29	40.3	27
4	STH 579	32	37.1	43
5	STH 586	55	35.0	84
6	STH 588	56	35.4	91
7	STH 563	36	43.1	35
8	STH 593	47	42.6	50
9	STH 594	61	38.4	82
10	STH 565	34	40.1	35
11	STH 561	28	40.1	26
12	STH 562	42	42.2	44
13	STH 599	31	38.5	32
14	STH 600	27	43.9	19
15	STH 602	30	49.2	15
16	STH 996	50	39.0	75
$LSD_{0.05}$		3	1.0	10
Spelt		18	51.6	11
Wheat – Begra		48	32.6	73
Wheat – Elena		27	27.4	2

Table 4. Farinograph analysis of flour of spelt and common wheat hybrids

No.	Hybrid/variety	Water absorption %	Dough stability min	Dough softening B.u.
1	STH 569	56.8	2.9	75
2	STH 570	58.8	4.9	50
3	STH 576	60.4	4.5	60
4	STH 579	59.6	5.0	50
5	STH 586	59.6	8.2	30
6	STH 588	61.8	9.2	30
7	STH 563	59.8	6.2	35
8	STH 593	64.8	7.5	40
9	STH 594	65.4	9.2	30
10	STH 565	60.6	5.4	35
11	STH 561	61.8	5.1	35
12	STH 562	63.2	7.4	35
13	STH 599	59.6	5.9	35
14	STH 600	61.4	7.7	15
15	STH 602	60.8	4.8	60
16	STH 996	62.0	8.6	30
Spelt		62.2	1.7	50
Wheat - Begra		61.4	1.4	25
Wheat - Elena		59.2	1.2	75

Table 5. Analysis of bread from flour of spelt and common wheat hybrids

No.	Hybrid/variety	Baking loss %	Yield of bread %	Volume of bread cm^3	Porosity of crumb %
1	STH 569	17.3	135	203	63
2	STH 570	17.6	136	277	78
3	STH 576	20.5	131	277	74
4	STH 579	17.4	136	228	74
5	STH 586	16.4	137	278	74
6	STH 588	19.4	132	288	82
7	STH 563	17.5	134	233	74
8	STH 593	18.7	132	261	82
9	STH 594	17.6	136	267	70
10	STH 565	20.5	129	317	82
11	STH 561	19.1	132	267	82
12	STH 562	17.4	136	223	78
13	STH 599	18.8	132	241	70
14	STH 600	21.0	129	279	78
15	STH 602	21.2	129	305	74
16	STH 996	21.8	127	322	78
$LSD_{0.05}$		1.1	7	8	8
Spelt		18.1	130	220	70
Wheat – Begra		20.5	131	292	74
Wheat - Elena		22.2	125	283	78

CONCLUSIONS

1. Differences in grain hardness between spelt hybrids reached 70%. However, no major relationship between this feature and the protein contents was found. Protein contents in spelt hybrids was lower by 2–5% than that in the spelt itself, however, it was higher than in the common wheat.
2. All the hybrids of spelt were characterized by higher Zeleny test results – indicating their better baking quality as compared with spelt. None of the hybrids matched the spelt as regards gluten contents. In turn, majority of them (12) surpassed spelt in terms of the gluten quality. Gluten content was higher by at least 2% in the hybrids than that in the Begra wheat variety itself – being rated as an A class wheat. Nevertheless, a majority – 12 out of 16 under test – featured lower quality.
3. A number of hybrids featuring improved milling and baking flour quality was obtained by hybridization of spelt *(Triticum spelta)* and the common wheat *(Triticum aestivum*). The STH 586, STH 588 and STH 594 hybrids were considered to have the greatest number of favourable technological features. Because of these features and good taste of bread the hybrids mentioned above may be sucessfully used for commercial baking.

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