

BREEDING OF NEW WHEAT VARIETIES WITH „PANNON” BREAD MAKING QUALITY IN SZEGED

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ABSTRACT – Breeding of new wheat varieties with „Pannon” Bread making Quality in Szeged

At the Cereal Research Non-Profit Ltd (CR) and at its progenitors breeding for high quality or improver quality wheat has a long history.

In our breeding programs selection for high quality does not separate from the main goals of the mainstream of general variety production: High bread-making quality must be attached to appropriate yielding capacity, and stability of yield.

Breeding activity basically runs by traditional methods (Pedigree-method) and a new variety can be produced during a ten to fifteen years period if we take in account the three years evaluation of the registration procedure.

The quality of the exported wheat shall satisfy primarily demand of the targeted foreign market. The demand for quality of foreign markets needs to apply in the quality tests in the home market and in the breeding process of wheat, because of the big part of Hungarian wheat production exported to West-European markets. “Pannon project” was started to satisfy better the quality parameters in the export of wheat, it acted on the wheat breeding at Szeged too, this study deals with it.

The main effects of the Pannon Project on the production of new wheat varieties with high flour quality:

During the selection procedure for flour quality besides the conventional quality tests (gluten content, farinograph value, loaf volume) we evaluated the grain hardness, Zeleny-value, the developing time and stability of dough, falling number, alveographic and extensographic parameters too. By applying these tests we found many wheat lines which has good characteristics according to one or more quality traits, and the same time had high yield capacity and their agronomic characteristics are also suitable.

Pannon project affected and still affects the breeding materials by means of the selection: hopefully the number of the genotypes which fit the Pannon requirements will increase in our breeding material. The other advantageous effect is, that we take in consideration the Pannon requirements when choosing the crossing partners for starting new combinations.

Keywords: winter wheat, breeding, bread-making quality, „Pannon quality criteria”

PREFACE

Breeding high or improving quality wheat has a long history at the Cereal Research Non-Profit Co. and its (MATUZ, KERTÉSZ 2001). For example: the maintenance of the world-famous Bánkúti 1201 wheat cultivar (Szülő Ferenc, Bacsa Pál) continued until the beginning of the 1970-ties. János Lelley and László Parádi produced the excellent quality winter wheat variety GK Tiszatáj here, which was the only quality standard in the state trials for decades. From the beginning of the 1980ties, from Szeged such highly productive and good quality varieties completed like GK Óthalom, GK István, GK Barna, GK Véka, GK Pinka, GK Csörnök, GK Kalász, GK Élet, GK Miska, GK Petur, GK Ati, GK Tisza, GK Békés.

Excellent bread making quality always was a fundamental goal of breeding even during the “quantity era”. The prove of this approach is the breeding of GK Tiszatáj and GK Óthalom. The three essential goals of the Szeged breeding program from 1975 which were set are: increasing the yield capacity, maintaining, or improving the technological quality, and increasing the safety of the yield.

The quality of exported wheat first of all must fit the demands of the export market. Since Hungarian wheat export predominantly tends to west-European markets it is practical to include all their quality characters to our quality tests and our breeding

procedure. By organizations which interested in wheat growing, marketing and utilizing, the Pannon program was initiated for the better gratification of the special quality parameters in wheat export. Of course, Pannon program had a significant effect on Szeged breeding program. The Szeged trials and results of „Pannon program” itself was reviewed earlier (MATUZ ET AL. 2008, ÁCS ET AL. 2008, PETRÓCZI, ÁCS 2008, MATUZ, ÁCS 2008).

MATERIALS AND METHODS

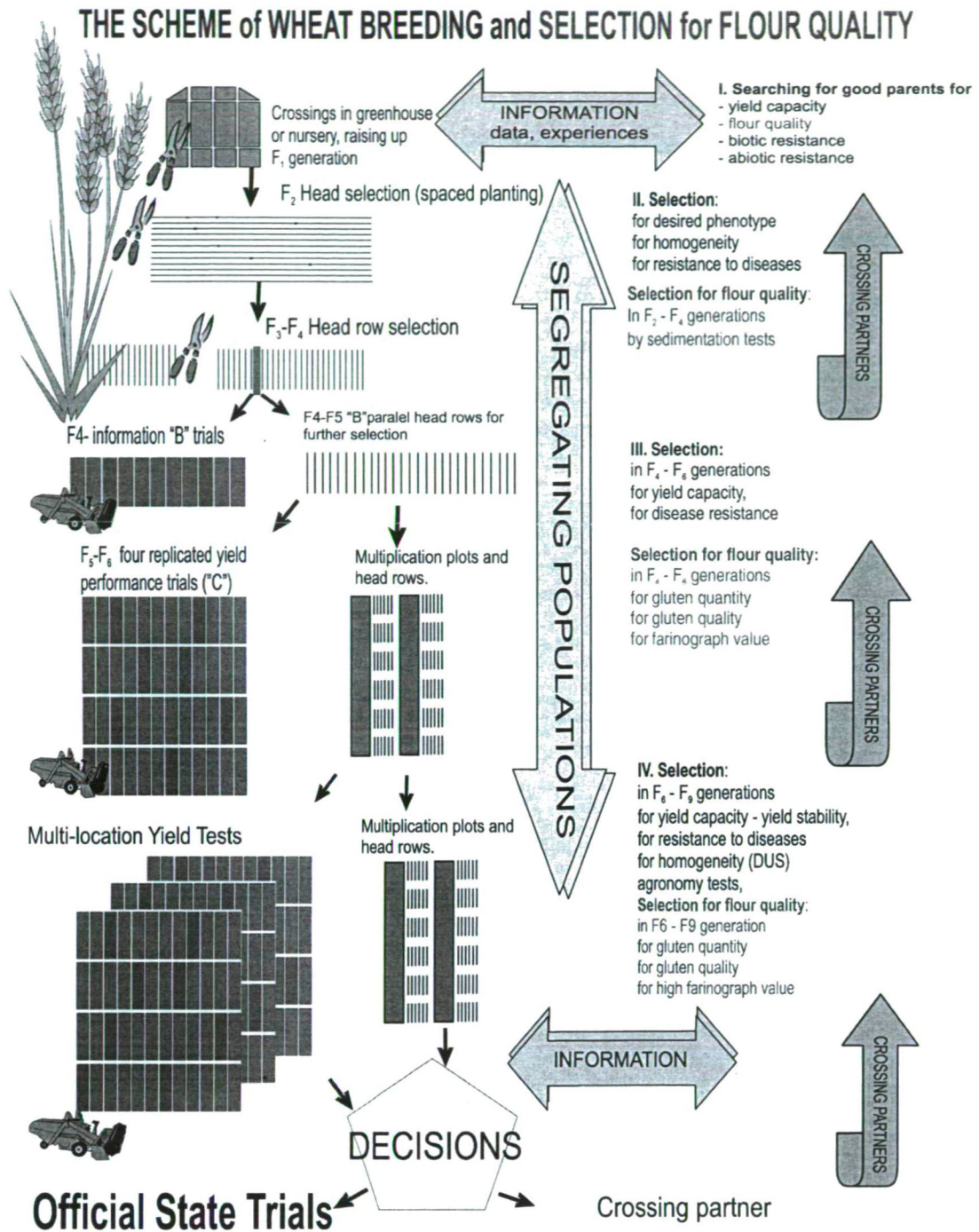
Pannon quality standard considers more quality characters than the Hungarian quality standard. Therefore we must include farinograph water absorption, developing time of dough, stability of dough, alveograph “W” and “P/L” values and extensograph measurements as selection criteria for breeding new varieties with Pannon quality.

Table 1 Pannon Quality Criteria

Quality tests	Pannon quality		Hungarian standard	
	Premium Category	Standard Category	Extra Quality	Milling I.
Test weight (kg/hl)	80.0	78.0	78	76
Wheat raw protein content min. (%)	14.0	12.5	12,5	12,5
Wheat raw protein content on dry matter basis min. (%)	16.0	14.5		
Moisture content max. (%)	13.5	13.5	14,5	14,5
Falling number min. (sec)	300.0	250.0	300.0	250.0
Grain hardness HI, min. (%)	60.0	50.0		
Grain composition				
Ash content (%)	0.5	0.5		
Flour raw protein content min. (%)	13.0	11.5		
Quantity of wet gluten min. (m/m %)	34.0	30.0	34.0	30.0
Flour Zeleny sedimentation value (ml)	50.0	40.0	35	35
Rheological properties				
<i>Farinograph values</i>			A1	B1
- Water absorption (on 14% moisture basis), min. (%)	60.0	55.0		
- Dough development time max. (min)	4.0	6.0		
- Dough stability time min. (min)	10.0	6.0		
<i>Alveograph values</i>				
- W min. (*10-4 joules)	280	220		
- P/L max.	1.0	1.5		
<i>Extensograph value</i>				
- Energy, 135 min proving time, min. (cm ²)	120.0	75.0		

At the CRC in Szeged, wheat breeding is going on by conventional methods and the production of a new cultivar takes about 10-15 years included the three years' evaluation in the Official Field Trials (*Fig. 1.*). In our program selection for high flour quality is not separated to the general aims of variety production: high or even excellent quality must be attached to a proper productivity and safety of the yield. For the sake of achieving of this goal, selection is repeated in every generation for high yields, flour quality and resistance to different diseases as shown on figure 1. (KERTÉSZ ET AL. 1997, KERTÉSZ, MATUZ 2006). We had to adopt to this process new selection procedures for the new quality characteristics which are recommended by „Pannon” program.

Figure 1.



RESULTS

Due to the Pannon program the next changes happened in our breeding procedure for high flour quality wheat varieties:

The number of quality evaluation methods increased

From the above-mentioned breeding procedure the next quality tests help us to search for the highest quality genotypes:

At early generations, segregating populations (F2-F4, heads and yields of "A"-lines):

Visual evaluation of grains (healthiness, color, form, plumpness), **grain hardness** (PERTEN SKCS 4100), **by NIR or NIT equipments, gluten and protein content, Zeleny test** (MSZ ISO 5529).

At „B”, C and advanced lines (F5-F ∞):

For fast screening we use the same tests than at the early generations,

Flour yield % (Brabender Senior mill), wet gluten content %, dry gluten content %, gluten elasticity (mm) (MSZ 6367/12-87),

Farinograph characters: the water absorption capacity of flour, **developing time and stability of dough**, Farinograph value

Baking test: loaf volume, loaf form coefficient, area of loaf segment

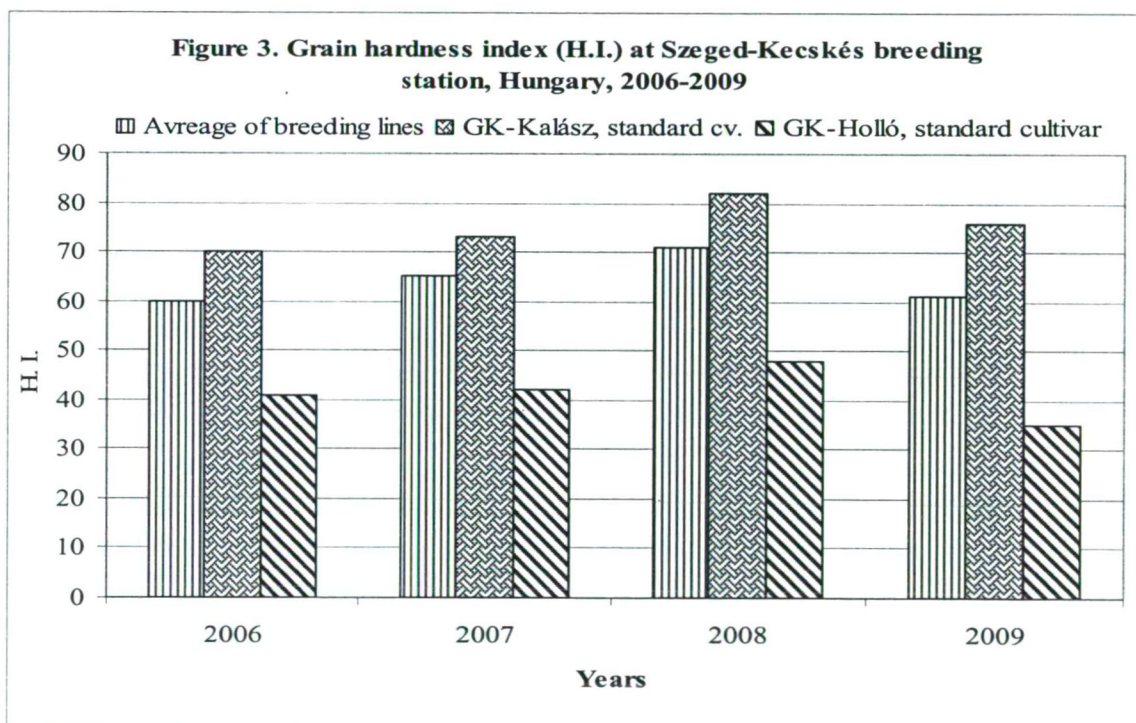
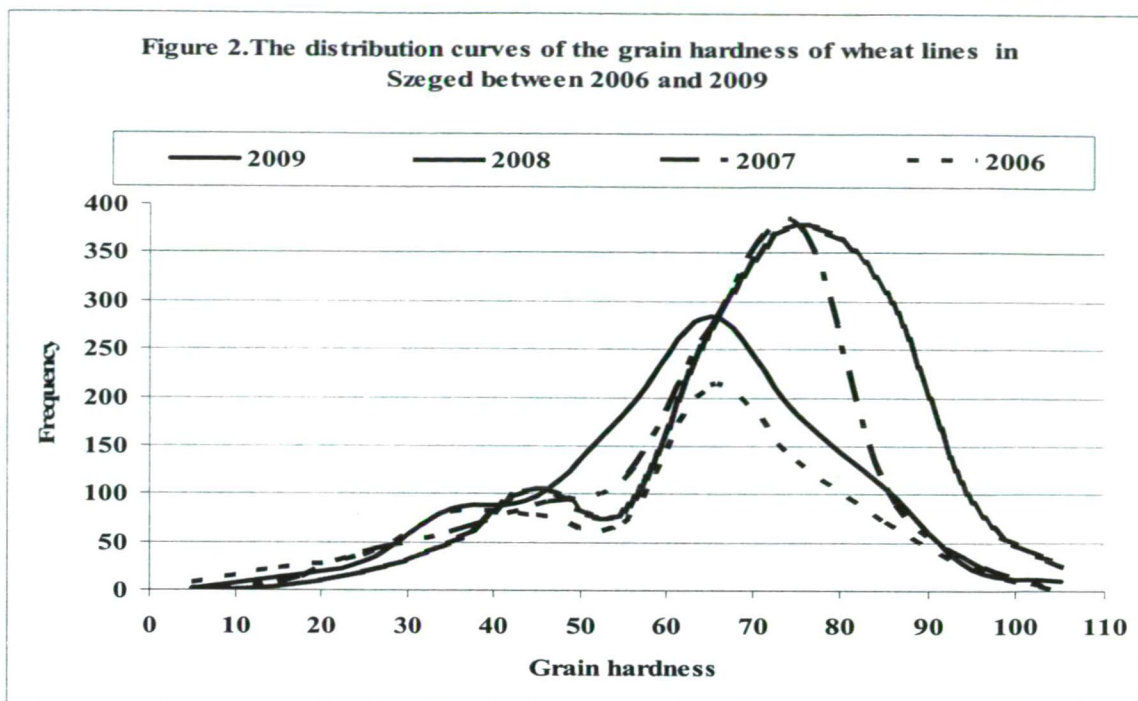
Falling number (ISO 3093:2009), alveograph test (ISO 5530-4), extensograph test (ISO 5530-2).

Screening quality tests with bold letters take part (or will take part) of our breeding system according to the recommendations of Pannon project. By using these evaluations in different screening and performance trials we could select many breeding lines with good performance in one or more quality characters, in addition to high yield capacity and adequate agronomic parameters appropriate for a modern wheat cultivar.

The results of the 2009 breeding material's evaluations:

- Among the tested variety candidates only one proved to be appropriate for all the 7 "Pannon" characters (protein content, falling number, grain hardness, wet gluten, Zeleny-value, farinograph water absorption, stability), 4 candidates did 6, and 3 candidates did 5 characters.
- Among the 28 advanced lines 5 hit "Pannon" level in all the 7 characters, 14 in 6 characters and 5 in five characters. 3 more lines in four characters and one line in three characters fit the demands.
- In 2009 113 more winter wheat lines were tested for 5 "Pannon" quality characters (protein content, falling number, grain hardness, wet gluten and Zeleny-value) and 35 samples fit the criteria of the quality demands. At 16 more lines 4 characters, at 47 lines 3, at 12 lines 2 and in case of two lines only 1 quality character could reach the limit values of Pannon standard.

Selection work and its efficiency highly depend on the year effect and weather conditions. For instance we have a long selection project for kernel hardness and for this purpose hundreds of lines were evaluated and all the soft types were discarded. According to the four years' data, the distribution of the wheat lines according to the grain hardness significantly does not change (Fig. 2). Between 2006 and 2008 generally the proportion of the hard grain lines increased, but in 2009 significant recurrence detected in this case. This consequence is happened due to the weather changes and because of the emergence of the numerous new breeding lines which haven't been selected for this trait yet. The data of the two control varieties shows the effect of the different years (Fig. 3.). The width of the distribution curves indicates that we have the possibility for select for extra hard and extra soft grains as well. On the other hand, control varieties show, that in spite of the important year effects varieties quite well retain their grain's hardness.



The other advantageous effect is that we take in consideration the “Pannon” requirements when choosing the crossing partners for starting new combinations.

On the other hand in this work we cannot skip other important agronomic characteristics (winter hardiness, resistance, stem etc.). No doubt that in breeding for quality how important the breeding material is since successful selection can be done only

from a wide genetic variability. In our breeding program we created numerous new crossing combinations for widening the genetic background of our material.

CONCLUSIONS

Pannon quality criteria determine two high quality clusters which will fit many demands of users. But we also know that the demands of the market are always changing. Therefore in all the long term projects, (in breeding) we must create more quality types of genotypes. Breeders must make long term plans while paying attention to foreign and domestic demands. We cannot be unilateral since the claims are always change here and abroad as well.

There is only one thing that will not change: We will need bread, flour for our life in the future too. For this, we will need good wheat, which will be our daily bread through the work of skilful farmers, millers and bakers.

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