INVESTIGATION OF WHEAT QUALITY ON DIFFERENT SAMPLES

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Abstract. The technology quality parameters of winter wheat were analysed on the results of a variety and cropping site experiment and a variety and mineral fertilizer field plot experiment. Results proves that the examined quality parameters suit the requirements of the intervention standard of European Union and international requirements for bread flour at average, but to reach safely the so called milling quality by the Hungarian Standard required higher input, especially mineral fertilizer supply. Results also show that the performance of newly bred and registered varieties is better in numerous parameters in common conditions. Results clearly show that the response of varieties to increasing mineral fertilizer doses is advantageous, and an adequate nutrient supply is guided by the requirements of selected varieties makes the results of quality more secure and the production more economical.

INTRODUCTION

There are several qualification methods to determine the quality of winter wheat, similarly to the varied demands of consumers (Kent, 1990). The quality parameters could be grouped as physical properties (hectolitre weight, one thousand kernels weight, grain hardness, moisture content), protein-linked properties (protein and gluten content, gluten index and expansiveness, sedimentation volume, protein and amino acid composition), rheologic properties (Farinograph or valorigraph test, Alveograph values, Extensograph test), enzymatic properties (Hagberg falling number, amylograph) and other examinations (ash content, test baking, micotoxin content and residues of pesticides and insecticides, e.g.). Beside inland consumption there is a significant wheat yield amount for export in Hungary, therefore it is important that our quality tests are known and accepted in several countries, and we also have to know the quality capacities of our varieties by different, rarely known methods. On the other hand, it is important to apply generally known, many times simple methods in production because of the quality based trading.

The different varieties could be classified to different processing aims by breeders and analytic laboratories. On the base of their results the farmers can choose varieties for plant production, but they also have to know the effect of different external factors (mineral fertilization, plant protection) on both yield and quality. To get this knowledge there are several scientific publications (Haneklaus and Schnug, 1992; Ragasits et al., 2000; Triboi et al., 2000; Pepó, 2002; Dachler and Kochl, 2003; Tanács et al., 2004; Szentpétery et al., 2004), what examine the quality variety specific way. The Central Laboratory of Centre of Agricultural Sciences, University of Debrecen posses several equipments to examine the wheat and flour quality by several ways, and as it is a laboratory of the University and
accredited by GAFTA and Hungarian Accreditation Board, there are numerous examined samples to draw conclusions on the connections of wheat quality and its influential factors.

MATERIAL AND METHOD

A field plot experiment was carried out at the Látókép Farm of University of Debrecen Center for Agricultural Sciences (UD CAS) (Ruzsányi, 1992). It is located 15 km from Debrecen in Hungary. The soil is a calcareous chernozem with 2.8-3.0 % humus content. The depth of the humus layer is 70-90 cm. The nitrogen and P supply of this calcareous chernozem soil is middle, the K content is high. The $\text{pH}_{\text{KCl}}$ is 6.2. Besides macro elements, there is no shortage of trace elements. Each treatment consisted of 46 m² plots, arranged in a randomized block design with four replication, where the basic treatment was the mineral fertilization; the additional treatments were crop rotation, irrigation and cultivation. Five levels of NPK fertilization doses were used. The experiment has been started 23 years ago in 1983. The applied dose of mineral fertilizers are 30 kg/ha N + 22.5 kg/ha $\text{P}_2\text{O}_5$ + 26.5 kg/ha $\text{K}_2\text{O}$ and their double, triple, four and fivefold. The nitrogen, phosphate and potassium was added to the soil as $\text{NH}_4\text{NO}_3$ with lime, superphosphate and KCl respectively.

Another source of samples is a variety and cropping site testing experiment. From these result almost 600 sample were selected to get the possibilities to draw conclusions on flour quality based on a large database

The samples were analysed in the Department of Food Science, Quality Assurance and Microbiology and Central Laboratory of UD CAS, only extensograph properties were analysed at the Central Laboratory of Pannonmill Inc., Komárom, Hungary. Flour from grains was made by MSZ 6367/9:1989 using LABOR MIM FQC-109 laboratory mill. List of methods and equipments used for qualifying flour samples is shown in Table 1.

BCR CRM 563 samples were used as control.

<table>
<thead>
<tr>
<th>Quality parameter</th>
<th>Method</th>
<th>Equipment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Protein content</td>
<td>MSZ 6367/11 – 84</td>
<td>Tecator Kjel-Tech</td>
</tr>
<tr>
<td>Wet gluten content and expansiveness</td>
<td>MSZ-ISO-5531:1993</td>
<td>LABOR-MIM and Glutomatic 2200</td>
</tr>
<tr>
<td>Gluten index</td>
<td>ICC No. 155</td>
<td>Perten Glutomatic</td>
</tr>
<tr>
<td>Extensograph properties</td>
<td>AACC-2000.54.10</td>
<td></td>
</tr>
<tr>
<td>Hagberg falling number</td>
<td>MSZ ISO 3093:1995</td>
<td>Perten Falling Number</td>
</tr>
<tr>
<td>Alveograph parameters</td>
<td>AACC-1983.54.30</td>
<td>Chopin Alveograph</td>
</tr>
</tbody>
</table>

RESULTS AND DISCUSSIONS

The results of the variety and cropping site experiments are visible in Table 1. The protein content suits the requirements of the intervention standard of European Union in the average of 590 samples (11.16%), but it is not reach the minimum of Hungarian Wheat
Standard (11.5%) (MSZ 6383:1998). The value of gluten content met the requirements of this standard (29.7%). The gluten index is about 93% and it suggests strong gluten in average. Nevertheless, the mean baking value is relatively low (50.46), but the another rheology parameter, the alveographic W value is high (262.8 \times 10^{-4} \text{J}). The mean falling number is 295 s.

There are more than one hundred registered winter wheat varieties in Hungary, but in 2005 12 winter wheat varieties was produced on the 62.4% of wheat cropping sites. Lupus is an Austrian variety, and it was registered in Hungary in 1998. Its spreading is continuous; this variety was the 7th frequent in seed production in 2003, 6th in 2005 and 3rd in 2005. The second selected variety is Mv Palotás, registered in 2000, which one is continuously the 4th on this list in the last 3 years. The third one is the GK Memento, which one is still under the registration process. It can be seen on Figure 1 that the performance of these newer varieties was better on numerous quality parameters than the mean of all samples. The improvement is expressed on the formation of wet gluten content, baking value, alveograph L and W value in the 2005 cropping year.

![Figure 1.: Flour quality of all and selected varieties from a variety and cropping site testing experiment (2005)](image)

We can compare the newer varieties to the so called standard varieties, GK Öthalom (registered in 1985) and Fatima (registered in 1993) based on the results of the variety comparison mineral fertilizer experiment at Látókép Experimental Station (Table 2). It can be seen that both in rheologic properties as baking value and wet gluten content the Mv Mazurka (registered in 2004) showed the best performance at control and highest fertilizer level as well. Especially its wet gluten content is notable; the samples from the control plot already showed milling quality in this parameter. Fatima and Lupus are the other varieties which show high wet gluten content in non fertilized conditions. Mineral fertilization increased the wet gluten content of these varieties to the 4th treatment, the highest dose caused commonly decrease. Nutrient supply also increased baking value, Mv Mazurka and GK Öthalom showed weaker fertilizer reaction than the others. Water absorption is a relatively stable quality parameter; the genotype effect is much stronger than the slightly increaser fertilizer effect.
The mineral fertilization caused 26-42% increase in protein content (Mv Mazurka showed the highest increase). Although the value of falling number mostly depends on weather, especially precipitation conditions, mineral fertilizer effect is also noticeable; the first two treatments increase its value, especially in the case of Fatima winter wheat variety, which had especially low falling number in the case of control and first treatment.

From the quality parameters of winter wheat flours the rheologic properties are the most important in food processing. In Hungary the qualification by valorigraph/Farinograph is the dominant, but in last times the qualification by Alveograph and Extensograph gives increasing emphasis. In our experiments the newly registered import varieties show the same proper quality as the ones bred in Hungary. Table 3 shows that selected varieties present suitable bread flour both by Hungarian and international requirements; the Alveograph W value above $250 \times 10^{-4}$ and the Extensograph energy between 90 and 150 is acceptable by numerous international markets.

Table 2.: Quality parameters of earlier and newly bred winter wheat varieties (Látókép, 2005)

<table>
<thead>
<tr>
<th>Variety</th>
<th>Treatment N / P₂O₅ / K₂O</th>
<th>Baking value, BU</th>
<th>Water absorption, ml</th>
<th>Wet gluten content, %</th>
<th>Falling number, s</th>
<th>Grain protein content, % in dm</th>
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</thead>
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<td>62,2</td>
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<td>63,8</td>
<td>35,07</td>
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</table>
To highlight the rheologic properties by valorigraph and Alveograph of two samples from the Látőkép experiment we can compare the reaction of these parameters to mineral fertilization (Table 4). It is clear to see that Fatima winter wheat variety has much expressed mineral fertilizer response in the climatic conditions of 2005; the best baking value and Alveographic W value were measured at 120 kg/ha N + PK dose. In the case of GK Öthalom the treatments resulted the best quality on a lower level nutrient supply (60 and 90 kg N + PK dose). The spectaculars changes were found as an effect to the first treatment; the baking value and W value increased about to half as much again as they were at control plots, but the effect of second fertilizer treatment is also significant on the performance of both varieties. These results point again to the importance of nutrient supply; beside yield the quality could be planning, and under different climatic conditions the stability of quality also increases.

### Table 4.: Valorigraph and Alveograph parameters of wheat varieties (Látőkép, 2005)

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Baking value, BU</th>
<th>Water absorption, ml</th>
<th>Alveograph parameters</th>
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<td>L, mm</td>
<td>G, ml</td>
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<td>71</td>
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<td>60/45/53</td>
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### BIBLIOGRAPHY