

EVALUATION OF QUANTITY AND QUALITY PARAMETERS IN WINTER WHEAT VARIETIES

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Introduction

In today's wheat production farmers put more and more focus on fulfilling the users' special quality needs – besides satisfying the quantity demands. In Hungary most of the winter wheat is used for bread-grain, but using it as a fodder also means great amounts of winter wheat. The quality parameters of bread-grain used in human consumption are determined by the flour-factory, the bakery and the batter-factory. The cultivation factors influence the winter wheat's yields, flour-factory and bakery characteristics (Bingham et al., 1968, Kárpáti et al., 1996). Generally, it can be stated that the quality and quantity productivity are a genetically determined feature of the given variety, which can be supported or destroyed by the environmental factors and the agricultural techniques – but they cannot improve them significantly (Polhamerné, 1981, Szentpétery et al., 1995). An important yield decreasing and quality destroying abiotic stress factor is germination before harvest, which can be developed by a long rainy period before harvest (Barnard – Bona, 2004). The bakery quality of winter wheat is influenced and developed by several factors. In wheat it is basic quality aspect to look through the factors that influence the flour-factory and bakery quality, which are mostly determined by the habitat's features (Miller Jones, 1995). Hungarian winter wheat classifying system is basically gluten oriented (Bedő et al., 1998). The wet gluten content is mainly determined by the variety's genetic characteristics, but it can be considerably supported by the weather, and the agro-technical features (Ruzsányi – Pepó, 1999). In their researches

Methods

At Látókép, the Experiment Site of the University of Debrecen under single agro-technological conditions, on small parcels, in four repetition, the productivity and quality characteristics of wheat varieties have been examined in 2002., 2003., 2004. Table 1. presents the change of climate parameters of the examined years. In the growing season of 2002, from the viewpoint of wheat development, the favorable autumn weather was followed by unfavorable, dry and warm spring period which made the growing period shorter, but the unfavorable effects has been moderated by the chernozem soil and better than average yields were realized. The growing period of 2003, was characterized by a dry autumn-winter followed by an exceptionally droughty and warm spring which effects were enlarged by the previous year's droughts and this appeared in the extremely low yields of the varieties. The climate of 2004, was optimal for the productivity of wheat which was proved by the high yields. In this study winter wheat variety with early (14), middle (13) and middle-late (4) ripening periods that were produced in the mentioned three years have been analyzed. Correlation analysis was used to analyze the experiments results.

Table 1. The change of meteorological parameters in the growing periods
(Debrecen, 2002-2004)

Years	Prec. in the growing season (mm) X.-VI.	Winter prec. (mm) X.-II.	Spring prec. (mm) III.-IV.	Early summer prec. (mm)	Temp. in the growing period (°C) X- VI.	Winter temp. (°C) X. – II.	Spring temp. (°C) III.-IV.	Early summer temp. (°C) V.-VI.
2001/02	184,6	77	34,3	73,3	6,9	2	7,9	18,3
2002/03	279,6	179,6	23,4	76,6	6,3	0,8	6,1	20,2
2003/04	376,5	211,3	86,7	78,7	6,6	1,9	8,1	17,1

Results and discussion

The effect of the last decade's more and more inevitable extreme weather anomalies (precipitation, temperature) are appeared in winter wheat production. During the years, the different than average year effects caused favorable and unfavorable results in the yield and quality characteristics of wheat varieties. In the examined three years period the highest yield were given by the early ripening varieties, the three years average of the ripening group is 5454 kg ha⁻¹, from which the middle ripening varieties fell behind only with 143 kg ha⁻¹ (5311 kg ha⁻¹). The lowest average yield was resulted in the middle-late ripening varieties during the given three years (4760 kg ha⁻¹). It could be interesting to mention that in the extremely droughty year of 2003 (2821 kg ha⁻¹) and the equally dry 2002 (5488 kg ha⁻¹) the highest average yield resulted from varieties of the early ripening group. Whereas in the year of 2004 which was optimal for wheat development the varieties of the middle-late ripening group provided the highest average crop (8114 kg ha⁻¹).

In the examined three years period based on the valorigraphic figure and the wet gluten content the comparative analyses of the quality characteristics of the different ripening groups and their winter wheat varieties were conducted. In the experiment period based on the average valorigraphic figure it can be stated that the value is the highest (41,4) in the varieties of the middle ripening group, and reached a nearly identical value (40,8) in the case of the early ripening genotypes. The average value of the given indicator in middle-late ripening group was 32,6. Examining the given years separately it can be stated that similarly to the yields the valorigraphic figure was the lowest in the droughty 2003 (29,1) and under optimal weather conditions in 2004 it was the highest (56,6), irrespectively from the ripening groups. Valuing the average wet gluten content of winter wheat varieties of different ripening groups, it can be stated that the highest gluten content (35,2%) resulted from the middle-late ripening varieties and the early ripening group only fell behind with 0,2%. The average gluten content of the middle ripening varieties showed 34,5%. In view of the wet gluten content from the examined three years it was 2003 that stood out with a result of 40%. Whereas the results of 2002 were below 30% in every ripening groups.

Table 2. The values of the correlation factor (Debrecen, 2002-2004)

	Prec. in the growing season (mm) X. – VI.	Winter prec. (mm) X. – II.	Spring prec. (mm) III.-IV.	Early summer prec. (mm)	Temp. in the growing period (°C) X- VI.	Winter temp. (°C) X. – II.	Spring temp. (°C) III. – IV.	Early summer temp. (°C) V. – VI.
Early ripening								
Yield	0,482**	0,209	0,907**	0,365*	0,497**	0,811**	0,888**	0,967**

Valorigraphic figure	0,506**	0,330*	0,719**	0,433*	0,198	0,481**	0,563**	-
Gluten %	0,136	0,397**	-	0,254	-	-	-	0,778**
Middle ripening								
Yield	0,569**	0,310	0,938**	0,460**	0,403*	0,764**	0,838**	-
Valorigraphic figure	0,388*	0,168	0,731**	0,294	0,401*	0,654**	0,716**	-
Gluten %	0,229	0,434**	-0,275	0,323*	-	-	-	0,577**
Middle-late ripening								
Yield	0,598*	0,338	0,488	0,488	0,384	0,739**	0,836**	-
Valorigraphic figure	0,188	-0,050	0,083	0,083	0,579*	0,758**	0,788**	-
Gluten %	0,496	0,693*	0,590*	0,590*	-0,886	-	-0,687*	0,487

** - Correlation on SzD1% level

* - Correlation on SzD5% level

Correlation analyses (Table 2.) were completed in every ripening group for every variety between the varieties' yields, valorigraphic figure, wet gluten content and the different meteorological parameters (precipitation, temperature). In every ripening group a positive correlation could be detected between the meteorological parameters and yields with the exception of the early summer average temperature. The winter and spring average temperatures have a very strong correlation with the crop. The negative correlation between the average temperature of May-June and the yield formed according to the early summer life-cycle of wheat. Examining the relation between the precipitation and the yields it can be stated that the rainfall during spring had a very strong positive correlation with the yield in every ripening group. As it can be seen in the table there is a very strong correlation between the valorigraphic figure and the spring precipitation in every ripening group. A similarly strong, negative correlation can be found between the early summer temperature (May-June) and the valorigraphic figure, which can be observed in the droughty years in every variety irrespectively of the ripening groups. It is noteworthy that while there is a strong positive correlation in the case of the middle and middle-late ripening groups between the winter temperature and valorigraphic figure, in the early ripening group there was a medium connection. Examining the correlation between the wet gluten content and the meteorological parameters it can be stated that between the spring precipitation and the gluten content a loose, negative relation can be observed in the middle and middle-late ripening groups. Whereas in the early ripening varieties this negative correlation is of medium strength. The correlation between the temperature of the growing period, the winter temperature and the wet gluten content is also negative, but very strong in every ripening group. There is also a strong negative correlation between the gluten content of wheat varieties and the spring temperature in every ripening group. The early summer temperature and the gluten content has a positive correlation in every case, but while in the early and middle ripening groups the correlation is strong, in the middle-late ripening varieties it is medium.

Conclusions

On the basis of our result, it can be stated that there are significant differences in the productivity and quality parameters of winter wheat varieties and they should be taken into account besides the conditions of the habitat. The favorable or unfavorable effects of the year-effect were obvious in the development of the yields. In the examined experimental period the best average yield was produced by the early ripening varieties (5454 kg ha^{-1}). Valuing the three years of the experimental period we can state that, in the drier period of 2002, the average yield of the ripening groups was between 4372 kg ha^{-1} and 5488 kg ha^{-1} . In 2003, because of the droughty climate the yields of the wheat varieties proved to be the lowest in that growing period (2236 kg ha^{-1} – 2821 kg ha^{-1}) irrespectively of the ripening group. The results of the experiment proved that the growing period of 2003/2004, was an optimal year from the viewpoint of wheat crop development. The average yields of the ripening groups were between 7673 kg ha^{-1} and 8052 kg ha^{-1} . The bakery quality indicators were also influenced by the year-effect. As a result of the unfavorable meteorological parameters the values of the valorigraphic figure showed an extremely low value in the three years' average irrespectively of the ripening groups (32,6-41,4). Similarly to the crops, the lowest values were produced in 2003 with the unfavorable weather (18,4-29,1). In the case of the wet gluten content in the ripening groups the highest content (42,8% - 46,5%) from the examined three years was found in 2003 with the unfavorable weather, which resulted from the forced ripening. Valuing the wet gluten content it can be stated that in every ripening group the genotypes belongs to the improving category. The results of the correlation analyses proved that the productivity and quality characteristics of wheat varieties are greatly determined by the year-effect.

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