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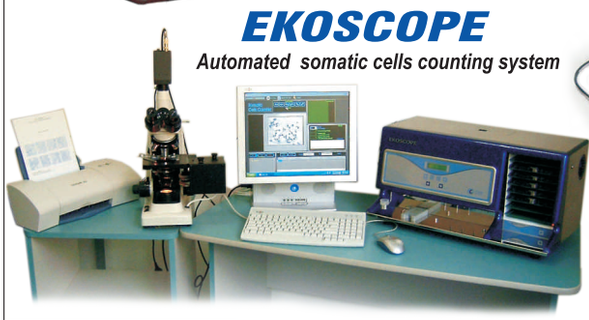

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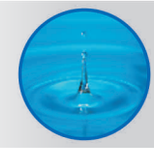

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Influence of genotype and environments on quality of winter wheat varieties in Northern Bulgaria

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Abstract. *The investigation included 16 varieties from first and second quality group according to the Bulgarian state standard. The aim of the investigation was to find out the level of influence of different environmental factors on wheat quality indices; to follow the response of the varieties to various combinations of growing conditions; to investigate the ability of the varieties to realize their potential for quality under specific environments. The investigation was carried out at Dobrudzha Agricultural Institute – General Toshevo (DAI) and at Institute of Agriculture and Seed Science, Obraztsov Chiflik, Rouse (OCH) during 2004 – 2007 by the Latin square method in 5 replications. The expression of 6 grain quality indices which give information about various quality aspects was analyzed: test weight, sedimentation value of flour, wet gluten content in grain, valorimeric value (valorimeter, conditional units), and loaf volume, determined according to the methods adopted at the DAI laboratory. It was found out that the independent influence of the genotype had the lowest effect on the variation of the quality indices of the investigated wheat varieties. The influence of the location was the highest on wet gluten content and valorimetric value. The year conditions had the highest effect on the expression of the characters test weight and loaf volume. The varieties from the quality group, compared to the varieties from the second group as a whole, realized their quality potential under more favorable combinations of conditions. Compared to the quality standard Pobeda, the varieties from the first group, which had lower mean values, were more stable to the changeable growing conditions. The varieties with higher indices differed in their response according to the standard. Most susceptible to changeable environments were varieties Demetra and Zlatina, and most stable were varieties Aglika, Albena and Preslav.*

Keywords: winter wheat, quality, genotype, environments, stability

Abbreviations: TW−test weight, SDS−sedimentation value of flour, WGC−wet gluten content in grain, Val−valorimeric value, Lvol−loaf volume, DAI–Dobrudzha Agricultural Institute, OCH−Institute of Agriculture and Seed Science, Obraztsov Chiflik, Rouse

Introduction

Wheat quality is a complex feature determined by the level of various indices and dependent on a number of factors. One of the problems of breeding for quality is not only achieving a high level of the indices in the new varieties, but also achieving a stable expression of these indices in different years and environments (Johansson et al., 2001; Atanasova et al., 2008; Williams et al., 2008). It will be valuable for breeding to determine the nature and direction of the effects of different genetic and environmental factors on the specific quality indices (Panozzo and Eagles, 2000; Tsenov et al., 2004; Hristov et al., 2010), and to study the performance of the varieties under changeable growing conditions. This would allow predicting to some degree their response to certain combinations of environmental factors (Yong et al., 2004; Drezner et al., 2006; Atanasova et al., 2010).

The variation of the quality indices when growing each individual variety under different environments is always helpful both for the distribution of the new varieties and for their improvement in breeding programs (Gomez-Becera et al., 2010). The data on the variation of winter wheat quality is contradictable with regard to the level of genotype effect (Williams et al., 2008; Gomez-Beccera et al., 2010). In breeding there is always the question whether the high quality of a given variety under favorable environments is a prerequisite for the realization of its high-quality potential under unfavorable environments, too, or if it is an impediment for its stability (Tsenov et al., 2004; Hristov et al., 2010). The aims of this investigation were: 1) to determine the level of influence of various environmental factors on the quality indices of wheat; 2) to follow the response of common winter wheat varieties to various combinations of growing conditions; 3) to study the ability of the varieties to realize their genetic potential for quality under certain environments.

Material and methods

The investigation was carried out at Dobrudzha Agricultural Institute – General Toshevo and at Institute of Agriculture and Seed Science, Obraztsov Chiflik, Rouse during 2004 – 2007. Sixteen varieties from first and second quality groups according to the Bulgarian state standard were involved in the investigation. The trial was designed by the Latin square method in 5 replications. The expression of 6 grain quality indices which give information about various quality aspects was analyzed: test weight (kg) (BSS 7971-2:2000), sedimentation value of flour (ml) (Pumpyanskii, 1971), wet gluten content in grain (%) (BSS 13375-88), valorimeric value (valorimeter, conditional units) (BSS 16759-88), and loaf volume, determined according to the methods adopted at the DAI laboratory. The analysis of variances was done by the package Statgraphics XV and the stability parameters were determined by the software GEST

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98 for studying the *genotype x environment interaction*. The most informative parameters were chosen – the coefficient of regression (b_i) by Finlay and Wilkinson (1963) and the ecovalence of stability by Muir et al. 1992. Genotypes with a bi value (1) <0.7 were considered unresponsive to changeable environments; (2) between 0.7 and 1.3 had average stability; and (3) >1.3 were considered responsive to good environments (Finlay and Wilkinson, 1963; Sudaric et al., 2006).

Results

The variance analysis showed significant effect of the main traits test weight, sedimentation, valorimetric value and loaf volume (Table 1). The variety's belonging to any of the quality groups did not affect significantly the expression of wet gluten content. Among the various interactions between the factors, only the *group x genotype* effect was significant for all traits, and the *location x genotype* interaction did not affect the expression of the traits, or its effect was only very slight (on test weight).

The mean values of the indices presented according to the effect of the different factors reveal that the growing conditions at DAI are more favorable; in this location the greater part of the investigated traits had higher values (Table 2). From the four years of investigations, year 2005 was the most favorable for the expression of the greater part of indices, with the exception of test weight. The highest values of test weight were achieved in 2004 and 2007. It is logical to expect higher values for the indices of the varieties from the first quality group. The results from the variance analysis were once again confirmed; the values for wet gluten content were not significant and there were no considerable differences between the two quality groups.

Table 2. Mean values of the investigated traits according to different factors of variation

Factors	TW	SDS	WGC	Val	Lvol
			Location		
DAI	81.2^{b}	39.4^{b}	21.6^{b}	43.7^{b}	673.8^{b}
OCH	78.9^{a}	33.1^{a}	19.3^{a}	38^{a}	636.9^{a}
			Year		
2004	81.5^{c}	36.5^{b}	20.0^{a}	42.4^{b}	641.1^{a}
2005	76.5^{a}	43.4^{c}	22.4^{b}	41.8^{b}	725.6^{b}
2006	80.2^{b}	31.3^{a}	18.4^{a}	41.7^{b}	633.1^{a}
2007	82.2^{c}	33.8^{ab}	21.0^{ab}	37.4^{a}	621.7^{a}
			Group of quality		
I-group	80.8^{b}	40.2^{b}	20.7^{a}	43.1^{b}	673.0^{b}
II-group	79.3^{a}	32.3^{a}	20.2^{a}	38.5^{a}	637.7^{a}

With different letters differ significantly.

The variations between the varieties in the respective quality groups are given in Table 3. The differences between the varieties and their response to the environmental conditions according to the traits test weight, sedimentation and loaf volume have already been considered in another publication (Atanasova et al., 2008). Here we are considering other two indices, which are also informative for the complex nature of wheat quality. In the first quality group, variety Aglika had the lowest wet gluten content (18.9), and variety Demetra – the highest (22.3). In the second group, varieties Kristy and Prelom were with the lowest wet gluten content (18.1 and 18.4, respectively), and variety Sadovo 1 had the highest value for this trait (22.1). However, the differences between the varieties from the two groups were not significant. The tendency of quality varieties accumulating lower amounts of wet gluten has been noted by other researchers as well (Panayotov and Rachinski, 2002; Tsenov et al., 2004; Atanasova et al., 2010). One of the reasons for this is the use of Russian and Ukrainian sources in the breeding programs for wheat quality improvement. These sources have high quality of gluten but in lower amounts. Another reason is the ongoing

Table 1. Analysis of variance (ANOVA) for mean squares of 16 wheat varieties

Source of variation	TW	SDS	WGC	Val	Lvol
Main effects					
A: Location	161.1***	1250.0***	170.4***	1058.0***	43512.5***
B: Year	205.5***	876.6***	91.6***	173.0***	72179.4***
C: Group	76.3***	2032.0***	7.9^{ns}	666.1***	39903.1***
D: Genotype	11.2***	28.9**	22.2***	48.7**	3868.2***
Interactions					
A x B	4.7***	94.6***	76.1***	8.4^{ns}	703.6^{ns}
A x C	7.3***	101.5***	17.3**	63.3**	2032.0^{ns}
A x D	1.1*	4.0^{ns}	1.5^{ns}	13.5^{ns}	942.4^{ns}
B x C	0.3^{ns}	15.6^{ns}	13.0**	26.4*	3650.5***
B x D	0.4^{ns}	21.5**	5.3^{ns}	9.0^{ns}	2273.9***
C x D	17.4***	172.7***	13.2**	157.4***	11036.6***

*P<0.1; **P<0.05; ***P<0.01; *ns*-not significant

enhancement of productivity in the new varieties which disturbs the balance between gluten content and grain yield (Tsenov et al., 2009).

Most of the varieties involved in this investigation have moderate stability of the trait wet gluten, having in mind the regression coefficient (b_i) (Table 3). Varieties Progress, Pliska and Prelom are specifically adapted to growing in unfavorable environments because they have low mean values of this character and their regression coefficients are below 0.7 (0.656, 0.654 and 0.671, respectively). Varieties Preslav, Aglika, Albena, Pryaspa, Sadovo 1 and Yantar are the most stable, their ecovalence values (W_i) are the lowest and therefore they deviate the least from the general mean value.

The valorimeric value is an index which determines gluten quality and which correlates strongly with end-use quality. The mean values of the varieties for this index clearly differentiated them in the two quality groups. There were some exceptions. Variety Enola, which is in the second quality group, realized comparatively high gluten amounts during the investigated period (44.9 cond. units), thus approximating the values of the varieties from the first quality group. Conversely, variety Albena, which is from the first quality group, had a mean valorimeric value at the level of variety Bolyarka, which is from the second quality group. This is yet another evidence for the complex nature of wheat quality and of the great effect not only of the genotype but of the growing environment as well. Most of the investigated varieties possess moderate stability (b_i from 0.7 to 1.3) with regard to the trait valorimeric value. Most stable were varieties Milena and Aglika (b_i = 1.00 and b_i = 1.25, respectively). They give evidence that high values of the traits can be observed in stable genotypes, too (Mladenov et al., 2001; Sudaric et al., 2006; Hristov et al., 2010) and that stability is not necessarily related to low mean values, as previously stated (Becker and Leon, 1988)

Table 3. Mean values and stability parameters of varieties from different quality groups

Variety	Wet gluten content			Valorimetric value		
	mean	b_i	W_i	mean	b_i	W_i
			I group			
Pobeda	22.4^{b}	1.174	21.15	40.4^{ab}	1.552	121.23
Albena	21.9^{b}	0.854	12.17	38.6^{a}	1.020	59.67
Preslav	19.7^{ab}	1.226	9.37	40.5^{ab}	0.648	26.26
Milena	21.4^{ab}	1.219	36.46	42.3^{abc}	1.000	21.33
Aglika	18.9^{a}	1.022	10.53	46.6^{bc}	1.251	89.42
Progres	19.3^{ab}	0.656	36.66	40.9^{ab}	0.700	42.86
Zlatina	19.8^{ab}	0.800	23.07	45.8^{abc}	1.855	274.20
Demetra	22.3^{b}	1.709	40.35	49.9^{c}	0.754	161.98
Average	20.71	1.08	23.72	43.13	1.10	99.62
			II group			
Sadovo 1	22.1^{b}	1.154	14.50	40.3^{ab}	1.331	133.08
Enola	20.4^{ab}	1.078	82.63	44.9^{b}	0.963	86.11
Pliska	21.3^{ab}	0.645	46.97	40.3^{ab}	0.963	14.58
Pryaspa	21.5^{ab}	1.229	14.30	35.0^{a}	0.912	23.51
Yantar	21.1^{ab}	0.860	15.44	36.8^{a}	0.658	41.83
Kristi	18.1^{a}	0.900	25.59	37.6^{ab}	0.736	70.67
Prelom	18.4^{a}	0.671	19.27	35.0^{a}	0.648	28.39
Boryana	18.9^{ab}	0.803	86.57	38.6^{ab}	1.158	56.17
Average	20.23	0.92	38.16	38.56	0.90	56.79

With different letters differ significantly.

Discussion

The effect of the location was the highest on wet gluten content and valorimeric value. The traits test weight and loaf volume were affected most by the year conditions. The distribution of the varieties into groups according to their quality had the highest influence on the expression of sedimentation. The independent influence of the genotype on the variation of most of the investigated indices was the lowest. Zhang et al. (2005) and Atanasova et al. (2008) have found out that the genotype had higher effect on the expression of sedimentation, while Panozzo and Eagles (2000), Tsenov et al. (2004), Drezner et al. (2006, 2007) have proved that the environment has greater effect on the quality indices of wheat. Among the various combinations between the factors, the interaction *quality group x genotype* had the highest effect on almost all investigated traits. The exception was wet gluten content, which was affected most by the interaction *location x year*. Mladenov et al. (2001), Williams et al. (2008), Hristov et al. (2010) have found out that in spite of the significant effect of the interaction *genotype x environment* on the expression of the quality parameters of wheat, this effect was less significant than the independent influences of the genotype and the location.

It is difficult in breeding for wheat quality to develop varieties with high quality indices, which remain stable under various growing conditions (Johansson et al., 2001; Atanasova et al., 2008; Williams et al., 2008). According to the results for the variation by valorimeric value of 22 common winter wheat varieties, the effect of the genotype amounted to 1/3 from the total variation (Atanasova et al., 2010). It is only by this index that the two quality groups involved in this study differ significantly. On the other hand, the ecovalence values of the individual varieties were very high, which brings forth the strong effect of the environment. The variation expressed through the ecovalence was much lower in the wheat varieties from the second group in comparison to the varieties from the first group (56.8 and 99.6, respectively) (Table 3). A number of researchers have found out that the varieties with lower quality potential are considerably more stable, especially under stress (Tsenov et al., 2004; Atanasova et al., 2010). The values of the regression coefficient of the separate groups are quite indicative in this respect. The regression coefficient in the first group was above 1: 1.08 and 1.1 for wet glutenin content and valorimetric value, respectively. This means that the varieties from this group realized their quality potential under conditions more favorable for its formation. Therefore the W_i values of variety Zlatina, which is a quality variety, were several times higher than the mean values for this group. On the other hand, varieties like Aglika, Milena and Preslav demonstrated considerably lower variation of their quality indices in comparison to the other varieties from the group. It can be suggested that such stability is due to the fact that the absolute values of the indices in this case were low; if they were higher, stability would in principle drop down (Atanasova et al., 2010).

Variety Pobeda, the quality standard according to the Bulgarian state standard, is moderately stable with regard to the trait wet gluten content and is specifically adapted to more favorable combinations of growing conditions with regard to valorimetric value (b_i = 1.174 and 1.552, respectively). The variety is moderately stable according to the levels of the ecovalence W_i as well. In comparison to the standard, the varieties from the quality group, which have lower mean values for wet gluten content, are more stable with a view of the ecovalence values. Such varieties are Aglika and Preslav. The varieties at the level of the standard Pobeda by their mean values behaved differently. Variety Albena had stable response to changeable growing environments, while variety Demetra was highly susceptible and unstable to changes of environments. With regard to the trait valorimeric value, the varieties with lower mean values in comparison to the standard were stable under changeable environments. Variety Milena, which was the most stable with a view of the regression coefficient and the ecovalence, had a mean value of this trait higher than the value of variety Pobeda. The other varieties which exceeded the standard by their level for this trait were moderately stable to highly unstable under changeable growing environments (varieties Aglika, Demetra and Zlatina). These data once again prove that when comparing the response of the varieties to the environment with regard to their quality, conclusions should be made very carefully. The results for the individual varieties and their indices are not unidirectional and therefore when selecting a variety for mass production it is necessary to consider the purpose for its cultivation, the potential of the given variety and its ability to realize this potential with stability and adequacy.

Conclusion

The independent influence of the genotype had the lowest effect on the variation of the quality traits of the investigated wheat varieties. The influence of the location was the highest on wet gluten content and valorimeric value. The expression of the traits test weight and loaf volume was most significantly affected by the year conditions. The varieties from the quality group compared to the varieties from the second group as a whole, realized their quality potential under more favorable combinations of conditions. According to the quality standard Pobeda, the varieties from the first group, which had lower mean values, were more stable under changeable environments. The varieties with higher levels of the indices behaved differently in comparison to the standard. Most unstable under changeable conditions were varieties Demetra and Zlatina, and varieties Aglika, Albean and Preslav can be considered stable.

References

Atanasova D, Tsenov N, Stoeva I and Todorov I, 2010. Performance of Bulgarian winter wheat varieties for main end-use quality parameters under different environments. Bulgarian Journal of Agricultural Science, 16 (1), 22-29.

Atanasova D, Tsenov N, Stoeva I and Dochev V, 2008. Genotype x environment interaction for some quality traits of Bulgarian winter wheat varieties. In: Modern Variety Breeding for Present and Future Needs (Eds. J. Prohens & M.L. Badenes), *Proceedings of the 18th EUCARPIA General Congress, 9-12 September, 2008, Valencia, Spain*, 532-537.

Becker HC and Leon J, 1988. Stability analysis in plant breeding. Plant Breeding, 101, 1-23.

BSS 7971-2:2000 – Bulgarian State Standard for test weight.

BSS 13375-88 - Bulgarian State Standard for wet gluten content in grain.

BSS 16759-88 - Bulgarian State Standard for valorimeric value.

Drezner G, Dvojkovic K, Horvat D, Novoselovic D, Lalic A, Babic D and Kovacevic J, 2006. Grain yield and quality of winter wheat genotypes in different environments. Cereal Research Communications, 34 (1), 457-460.

Drezner G, Dvojkovic K, Horvat D, Novoselovic D and Lalic A, 2007. Environmental impacts on wheat agronomic and quality traits. Cereal Research Communications, 35 (2), 357-360.

Finlay KW and Wilkinson G, 1963. The analysis of adaptation in a plant breeding programme. Australian Journal of Agricultural Research, 14, 742-754.

Gomez-Beccera HF, Abudalieva A, Morgunov A, Abdullaev K, Bekenova L, Yessimbekova M, Sereda G, Shpigun S, Tsygankov V, Zelenskiy Y, Pena RJ and Chakmak I, 2010. Phenotypic correlations, G x E interactions and broad sense heritability analysis of grain and flour quality characteristics in high latitude spring bread wheats from Kazahstan and Siberia. Euphytica, 171 (1), 23-38.

Hristov N, Mladenov N, Djuric V, Kondic-Spika A, Marjanovic-Jeromela A and Simic D, 2010. Genotype by environment interactions in wheat quality breeding programs in southeast Europe. Euphytica, DOI 10.1007/s10681-009-0100-8, online first.

Mladenov N, Misic T, Przulj N and Hristov N, 2001. Bread-making quality and stability of winter wheat grown in semiarid conditions. Rostlinna vyroba, 47, 160-166.

Muir W, Nyquist WE and Xu S, 1992. Alternative partitioning of the genotype-by-environment interaction. Theoretical and Applied Genetics, 84, 193-200.

Johansson E, Prieto-Linde ML and Jonsson JO, 2001. Breeding for stability in bread milling quality. In: Z. Bedo and L. Lang (eds.) Wheat in a Global Environment, Kluwer Academic Publishers, Netherlands, 229-235.

Panayotov I and Rachinski T, 2002. Wheat breeding as a basis of grain production in Bulgaria. *50th Anniversary of Dobroudja Agricultural Institute "Breeding and Agrotechnics of field crops*", *1st June 2001, Dobrich,* vol 1, 21-37. (Bg)

Panozzo JF and Eagles HA, 2000. Cultivar and environmental effects on quality characters in wheat. 2. Protein. Australian Journal of Agricultural Research , 51, 629–636.

Pumpyanskii AY, 1971. Technological characteristics of common wheat. L., pp. 22 (Ru).

Sudaric A, Simic D, and Vrataric M, 2006. Characterization of genotype by environment interactions in soybean breeding programmes of southeast Europe. Plant Breeding, 125, 191-194.

Tsenov N, Kostov K, Gubatov T and Peeva V, 2004. Study on the genotype x environment interaction in winter wheat varieties. I. Grain quality. Field Crop Studies 1(1), 20-29. (Bg)

Tsenov N, Kostov K, Todorov I, Panayotov I, Stoeva I, Atanassova D, Mankovsky I and Chamurliysky P, 2009. Problems, achievements and prospects in breeding for grain productivity of winter wheat, Field crop Studies 5(2), 261-273. (Bg)

Williams RM, O'Brien L, Eagles HA, Solah VA and Jayasena V, 2008. The influence of genotype, environment, and genotype x environment interaction on wheat quality. Australian Journal of Agricultural Research, 59(2), 95-111.

Yong Z, Zhonghu H, Ye G, Aimin Z and Van Ginkel M, 2004. Effect of environment and genotype on bread-making quality of spring-sown spring wheat cultivars in China. Euphytica, 139 (1), 75-83.

Zhang Y, Zhang Y, He Z and Ye G, 2005. Milling quality and properties of autumn-sown Chinese wheats evaluated through multi-location trials. Euphytica, 143 (1-2), 209-222.

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