THE YIELD AND QUALITY OF SOME WINTER WHEAT VARIETIES IN TISA PLAIN CONDITIONS

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Abstract

There are presented the results regarding the yields and quality parameters of Crisana whinter wheat variety in 4 locations in Tisa Plain during the year 2011. The locations were: Oradea, Felnac and Gataia (from Romania) and Kiszombor (from Hungary). Even the climatical and technological conditions were differents, the results are comparables and varieties reactions stables. Crisana variety is a middle yielding one but with good milling and backing qualities. The general tendency is the decrease of quality when yield are increassing, with some exceptions. The new breeding line Oradea 18 have a very good yield potential, miling and bakering quality. The varieties: Adelaide, Exotic, Apache, G.K.Csillag, G.K.Elet, Arlequin and Garcia are very productive but with low quality. In opposition, the varieties Faur, Boema, Lovrin 34 and Ciprian have pour yield potentials, but a very good wet gluten contents.

Key words:: correlation, wet gluten, wheat variety, yield.

INTRODUCTION

In Romania, the average area cultivated with winter wheat reaches about 2 million ha, with a total production between 7 and 12 million tones/ year, but only 2- 5 million tones are acceptable in terms of quality.

In western Romania (Tisa Plain), one of the most important area for the winter wheat, some Romanian varieties are cultivated (Dropia, Boema, Flamura 85, Glosa, Alex, Romulus, Ciprian, Lovrin 34, Ariesan and Crisana), all being appreciated for their good qualities (Tabara and all., 2011). In 2008, the most cultivated varieties in this area were: Alex, Romulus, Dropia, Ariesan, Serina and Josef.

In Hungary, more than a hundred cultivars are registered, some of them reaching numerous quality parameters: Lupulus (Austrian cultivar), Mv. Palotás, G. K. Rozi, G.K. Bekes. Fatima and Lupulus show high wet gluten content in non fertilized conditions (Győri Z. and Sipos P., 2006). Some of these varieties are cultivated in western Romania, too.

Generally, wheat quality is defined by:

- Physical properties: hectoliter weight, (TKW), grain hardness,
- Protein-linked properties: total protein and gluten contents, gluten index, expansiveness, sedimentation volume, protein and amino-acids;

- Reologic properties: farinograph or valorigraph test, alveograph value;
- Enzymatic properties: Hagberg falling number, amilograph test;

Wheat quality, especially protein content and bread-making quality, is influenced by the type of soil, climate conditions, nitrogen fertilization, plant protection and genotype (Pepó P., 2002; Ranieri R., 2000; Szentpétery Zs. et all, 2004; Tanács L. et all, 2004). The mineral fertilization can increase the protein content by 26- 42%.

Other authors (Ranieri R., 2000) appreciate that the stability of wheat quality is strongly dependent on genotypes, agricultural production technology, soil fertility, nitrogen fertilization and water availability.

High yielding ability with good bread-making quality is the main aim in bread wheat breeding programs (Şemun T., 2008). It is known that the baking quality of wheat is under genetic as well as environmental control (Lupton, F., 2005). Another authors (Kadar R. et all, 2009) concluded that the heritability coefficients are small for protein content, but large for sedimentation index, gluten content and deformation index. The cultivars created at A. R. S. Turda (Apullum, Turda 95 and Turda 2000) are considered to be a new level of quality in Central and North Romania.

The genetic and molecular control of cereal quality and methods for its manipulations is possible by conventional breeding methods or by genetic engineering (Snape J. Et all, 2005). Using genetic maps, they concluded that the protein content is associated with markers on chromosomes 1A, 2B, 2D, 3B 5BS/7BS and 6B.

A group of co-workers (Tabără V. et all, 2008) present the standard values for wheat quality in Romania (812- ISO 7970/2001): hectoliter weight more than 75 kg/hl, falling number between 180-260 seconds, wet gluten more than 22%, gluten index between 65 and 80%.

MATERIAL AND METHOD

The climatical conditions are similar in western Romania and east southeast Hungary, respectively Tisa Plain. For this reason, a variable series of varieties was tested both in Hungary (Kiszombor, near Szeged) and western Romania (Gataia, Felnac and Oradea). All the experiments were conducted during the year 2011.

The varieties tested are from Romania, Hungary and from other European countries: France Austria, Italy, Spain, and Serbia. The total number of variants tested was 119, some of the varieties being present in 2, 3 or all 4 locations (such as Crisana, Dropia and Apache). The experiments in Kiszombor, Gataia and Felnac were carried out in randomized blocks, in three replications and those in Oradea, in lattice square balanced.

The results were statistical processed by correlation and regression and analyzed of variances and limit standard deviation.

The results regarding the wet gluten, protein and sedimentation index were obtained by using an Infratech apparatus.

The fertilization vas different in various places: 57 kg/ha (active substance) P + 15 kg/ha K and 124 kg/ha N, in three stages (Kiszombor), 163 kg/ha N in 3 stages (Gataia), 84 kg/ha N (Felnac), 100 kg/ha N (Oradea). For this reason, the varieties yield results are comparable one to another, only if they were obtained in the same location.

RESULTS AND DISSCUSIONS

In 2011, the yields varied in the experiment conducted in Oradea (table 1) between 3.423 kg/ha (Dropia, considered to be a very good quality variety) and 6.784 kg/ha (Kiskun Gold).The best variety tested in Oradea, statistically ensured, was Kiskun Gold, followed by a breeding new variety, Oradea 18 and the varieties Litera, Delabrad, Apache, Ariesan and Capo. The list yielding varieties were: Dropia, Flamura 85 and Lovrin 34 (Romanian old varieties), Glosa, Faur and Ciprian.

Regarding the backing quality, it is important to observe that the total protein content varied between 14.3% (Serina) and 11.0% (Lovrin 34). Gruia and Miranda varieties recorded good protein content, as well.

With a usual quality index, wet gluten (%), has good values in the case of Serina, Miranda, Gruia and Crisana varieties. The values of wet gluten did not correspond in case of Apache, Alex, Ciprian and Flamura 85.

The third important index of backing quality, sedimentation index was very good in case of Josef, Delabrad, Ardeal and Serina, with sedimentation values up to 40 ml. Capo and Lovrin 34 had such extremely pour sedimentation index values that AgriCheck laboratory apparatus could not determine their values.

One must outline that the new breeding line of wheat, Oradea 18, has very good yielding potential, good protein, wet gluten content and sedimentation index.

Table 1

Yields and quality results of some wheat varieties. Oradea, 2011.							
Variety	Yield	Relative	Differ.	Signiff.	Protein	Wet	Sedimen-
	(kg/ha)	yield (%)	(kg/ha)	Differ.	(%)	gluten	tation
						(%)	index (ml)
Kiskun Gold	6784	126.1	+1404	***	12.5	26	25
Oradea 18	6265	116.4	+885	***	13.2	26	35
Litera	6167	114.6	+787	**	13.1	26	33
Delabrad	6160	114.5	+780	**	13.3	26	40
Apache	6091	113.2	+711	**	11.1	20	27
Ariesan	5981	111.2	+601	**	13.0	26	33
Саро	5834	108.4	+454	*	11.7	23	*
Gruia	5819	108.2	+439		13.7	27	37
Izvor	5797	107.7	+417		12.3	23	26
Ardeal	5670	105.4	+290		13.3	26	40
Miranda	5570	103.5	+190		13.7	28	43
Josef	5526	102.7	+146		13.2	26	41
Alex	5442	101.2	+62		11.3	20	15
Renesansa	5424	100.8	+44		12.3	24	27
Exp. Average	5380	100.0	0	-	12.5	24.2	28.7
Romulus	5274	98.0	-106		12.9	25	34
Boema	5267	97.9	-113		12.4	24	26
Serina	5186	97.4	-194		14.3	31	41
Kristina	5174	97.2	-206		11.9	23	24
Crisana	5145	95.6	-235		12.6	27	32
Ciprian	4807	89.3	-573	0	11.3	20	16
Faur	4691	87.2	-689	00	11.7	21	14
Glosa	4610	85.7	-770	00	11.9	23	22
Lovrin 34	4376	81.3	-1004	000	11.0	19	*
Flamura 85	4036	75.0	-1344	000	11.4	20	16
Dropia	3423	63.6	-1957	000	11.9	22	24

Yields and quality results of some wheat varieties. Oradea, 2011.

LSD_{5%} =444 Kg/ha; LSD_{1%} = 600 Kg/ha; LSD _{0.1%}+ 800 Kg/ha.

Figure 1 presents the correlation between wheat yield and protein content. The linkage is evident, with some exceptions: Apache and Capo have good yielding potential, but low protein content; as for Serina, even if its yield is only an average one, its quality is better than that of other varieties in its group.



Fig. 1. The link between yield and protein content in some wheat varieties. Oradea, 2011. Between yields of varieties and another quality index, wet gluten, the corelation is more evident (fig. 2). The negative exceptions are Apache and Alex and the positive ones are Serina and Crisana. The breeding line Oradea 18 is comparable for this point of view with two good varieties created at Fundulea, Litera and Delabrad.



Fig. 2. The link between yield and wet gluten content in some wheat varieties. Oradea, 2011.

The experiment conducted at Kiszomor (fig. 3), in different technical conditions, points out some wheat varieties with good yield (up to 7000 Kg/ha), like: Adelaide, Exotic, Apache, G.K.Csillag, G.K.Elet, Arlequin, and Garcia. From this group of good yielding varieties, only Exotic has good wet gluten content.

The lowest content in wet gluten has Garcia and Banquet, but these two varieties are used in biscuit industry. Another group of varieties (Soissons, Apache, Arlequin) from France are very productive, but with pour quality.

Some Romanian varieties (Faur, Boema, Lovrin 34 and Ciprian) achieved low yields but with very good gluten content. Crisana has a good yield potential (exceeding 7.000 kg/ha) and quality (26.5% wet gluten),

comparable with G.K.Rozi, G.K.Kalasz, G.K.Feny, G.K.Koros and G.K.Petur (all created at A.R.I. Szeged, Hungary). All these varieties have good yielding and have good backing quality. Therefore, Crisana variety is competitive with the Hungarian varieties.



Fig. 3. The link between yield and wet gluten content in some wheat varieties. Kiszombor, 2011.

Another experiment conducted in Romanian Banat area (Gataia, Timis county) with 37 varieties, with comparable climatic conditions, repeated the same scheme of organization (fig. 4). Kubus, Altigo, Apache, Azimuth and Garcia (around 7.000 kg/ha) had very good grain yield, yet all of them had low content of wet gluten. G.K.Bekes, Josef, B 52, Faur, Alex and Capo had very good content of wet gluten, but here yields did not exceed 6.200 kg/ha.



Fig. 4 The link between yield and wet gluten content in some wheat varieties. Gataia, 2011. Another experiment was conducted at Felnac, in the neighbouring county of Arad (fig. 5).



Fig. 5 The link between yield and wet gluten content in some wheat varieties. Felnac, 2011. There, the levels of grain yield were lower than in the precedent locations, but the tendency was the same: the varieties with very good yield (Azimut, Artico, Arlequin, Altigo, Banquet and Garcia) had low quality (lower than 25% wet gluten content). The varieties with good quality (Antonius, Josef, B 52, Emerino, Renan, Avorio, Crisana and Capo) achieved only 4.500-5.000 kg/ha.



Fig. 6. The polynomial trend between yield and wet gluten.

In an attempt to identify the general tendency in relation between yield and quality, we analyzed the functions which best reproduce this relation: linear, exponential, power, logarithmic and polynomial (2) trend (fig. 6). The trend function, ensured statistically, was the polynomial one. There is one zone, under 5.000 kg/ha, where the wet gluten content enrich with yield (positive trend). This situation is done by using fertilizers. The next zone (between 5.500 and 6.500 kg/ha) is the optimal one, where the genetic factors interfere with level of fertilization. Up to this level of yield, the content of wet gluten decline, the explanation of this situation being a genetic one: the varieties with very good yield potential have low backing quality.

CONCLUSIONS

The content of wet gluten depends of two factors: genotype and fertilization.

The varieties with good yielding potential are, in general, the same in all locations and the genotypes with good wet gluten repeat the same tendency.

The variety Crisana has a good yield potential, competitive to the varieties from the same class of quality.

The breeding line Oradea 18 is a promising one, with good yield and quality. There are some varieties with optimal ratio between yield and quality: Crisana, G.K.Rozi, G.K.Kalasz, G.K.Feny, G.K.Koros and G.K.Petur.

Acknowledgments

The results from Kiszombor, Gataia and Felnac were obtained in collaboration with commercial society Agro Clasic, conducted by eng. O. Guler.

REFERENCES

- Győri Z., Sipos P., 2006, Investigation of wheat quality on different samples. Buletin USAMV-Cluj-Napoca, 62. pp. 258-263.
- Kadar R., Moldovan V., Moldovan M., 2009, Genetic progress in breeding of breadmaking quality in winter wheat at ARS Turda: opportunities and constrains. Ann. Wheat Newsletter, 47, pp. 139-140.
- 3. Lupton, F., 2005, Advances in work on breeding wheat with improved grain quality in the twentieth century. The J. of Agric. Science., 143, pp. 113-116.
- Pepó P., 2002, Öszibúza-fajták trágyareakciója eltérő évjáratokban. Nővénytermelés, 51, pp. 189-198.
- 5. Ranieri R., 2000, Durum wheat quality management. CIHEAM- Options Mediterranean's, pp. 555-557.
- Snape J., Fish L., Leader D., Bradburne R., Turner A., 2005, The impact of genomics and genetics on wheat quality improvement. Turk J. Agric. 29, pp. 97-103.
- Szentpétery Zs., Hegedűs Z., Jolánkai M., 2004, Impact of agrochemicals on yield quality and pesticide residues of winter wheat varieties. Cer. Res. Comm., 32. 2, pp. 635-642.
- Şemun T., 2008, Grain yield and agronomic characteristics of Romanian bread wheat varieties under the condition of Northwestern Turkey. African J. of Biotechnology, 7 (10), pp. 1479-1486.
- Tabără V., Puscă I., Wagner L., Pop G., Nită S., Gorinoiu Gabriela, Prodan M.,2008, Calitatea panificabilă a unor soiuri de grâu de toamnă în conditiile Statiunii de cercetări Agricole Lovrin. Bul. AGIR, 1-2., pp. 3-6.
- Tabără V., Nită S., Pop G., Prodan M., Duma C., Tabără C. G., Pasca M., Nedelcu F., 2009, Breadmaking quality of some winter wheat cultivars in western Romania. Bul. AGIR, 1-2, pp.182-185.
- 11. Tanács L., Matuz J., Gerő L., Petróczi I. M., 2004, Effect of NPK fertilizers and fungicides on the quality of bread wheat in different years. Cer. Res. Comm., 32. 2, pp. 627-634.