Quality Features Analysis of an Assortment Of Winter Wheat Genotypes Tested at A.R.D.S. Turda, in The Year of 2014

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ABSTRACT

Worldwide, the breeder efforts are focused in creating new winter wheat varieties with high quality parameters, according to the demands of the bakery industry. The natural conditions in Transylvania are very diverse. High-quality wheat varieties are required, therefore the aim is to detect and to create well-adapted winter wheat varieties to these local area conditions for obtaining high production and high quality features for this crop. To become aware of the valuable genotypes grown in the central and northern area of the country were studied quality characters from an assortment of the most common winter wheat varieties, tested at A.R.D.S. Turda, in the year of 2014.

Keywords: *winter wheat, quality analysis, Turda area, production.*

INTRODUCTION

Creating winter wheat genotypes that comply the requirements of the bakery industry in terms of its quality, it is one of the objectives for worldwide breeders. Over time, there have been made many studies on the variability in the protein content of wheat in fertilizer-free culture conditions and different levels of fertilizer (VOGEL et al., 1973; HRUSKOVA et al., 2000; HUSSAIN et al., 2006; MARQUE et al. 2004). Considering that not only fertilization influence the accumulation of grain protein and in consideration of climate change, the paper studies the protein content for 100 winter wheat genotypes under stress caused by chemical desiccation. Also wet gluten content and ash content were studied in this paper for 100 chemical desiccated winter wheat genotypes. The most important are gliadin and glutenin proteins that form gluten in the presence of water. It gives bread dough main characteristics of (<http://www.rompan.ro/grau/>).

In terms of ash content of flours can be achieved classification according to quality classes.

MATERIAL AND METHODS

Experience was placed in the experimental field of cereals breeding laboratory in Turda, in the year 2014.

Quality indices were studied for 100 winter wheat genotypes at S.C.D.A. Turda in the year 2014. In the autumn of 2013, each genotype was sown by hand on 4 m rows, at 25 cm distance between plants in the row, resulting in a harvested area 1 m². To identify the influence of drought on these quality indicators, 2 weeks after flowering, genotypes were treated with NaClO₃ (2%) in order to induce drought artificially. This method of chemical desiccation was proposed by Blum (1988) and used by Cereal Research Non-profit company Szeged (2002) to determine drought

resistance of some winter wheat genotypes. Quality parameters were studied for the genotypes cultivated in normal conditions and also for the chemical desiccated genotypes.

The flour for establishing quality indicators was achieved by grinding wheat samples with laboratory mill SJ 500. Using NIR analyzer from the company Dickey-John Instalab 600 were determined:

- protein content;
- wet gluten content;
- ash content.

To identify the genotypes with high production potential, production was calculated for winter wheat genotypes studied.

Climatic conditions in the year 2013-2014 were favorable for winter wheat crop (Fig. 1, Fig.

2). The genotypes studied had the right conditions to express at the level of production potential. Because of the rains in April, winter wheat plants had a luxuriant growth, the blooming was achieved with 9-14 days earlier than normal.

RESULTS AND DISCUSSION

Table 1 presents the variability parameters for protein content obtained at 100 winter wheat genotypes studied in the year 2014, at A.R.D.S. Turda. The average of protein content for the genotypes grown in normal conditions (8.57%) was lower than protein content recorded for genotypes under chemical stress (10.42%).

In the case of genotypes untreated with NaClO_3 the range of variation for protein content

Fig. 1. Temperatures between 1st of August 2013 and 3rd July 2014 at Turda (°C)

Fig. 2. Rainfall between 1st of August 2013 and 31st July 2014 at Turda (mm)

was 5% with limits between 6.4 and 11.4%. The small standard deviation value (0.82) indicated that the experimental results had values around their average. The coefficient of variation (s%) calculated denote a reduced variability of statistical repartition.

The protein content for chemical desiccated genotypes was between 8.4 and 13.7% with a range of variation of 5.3 %. For these ones, standard deviation shows that the protein content, in most analyzed genotypes, has values close to the average. The coefficient of variation indicated a medium variability of statistical repartition. These results confirm that dry climates favor the accumulation of protein in winter wheat grain.

The distribution of winter wheat genotypes studied for protein content (Fig. 3) shows that in dry conditions, 61 of the analyzed genotypes have a higher protein content of 10% while in normal condition, only 3 genotypes recorded values for protein content higher than 10%. Among the 10 genotypes with the highest protein content (Table 2) are found varieties but also perspective lines of winter wheat genotypes. Apullum and Aniversar varieties had a protein content higher than 10% in normal conditions and over 12% in dry conditions. We also recomand for breeding programs in terms of protein content to use as genitors varieties like Capo, Rovine, GK. Kalasz, Bezostaia but also lines like: T.265-01, T.126-

Tab. 1. Protein content parameters variability for 100 winter wheat genotypes studied at A.R.D.S. Turda in the year 2014

Protein content (%) (Turda, 2014)		
	Treated	Untreated
Statistical population	100 genotypes	100 genotypes
Mean	10.42	8.57
Standard deviation	1.15	0.82
Skewness	0.52	0.86
Range of variation	5.3	5
Range of variation	Minimum	6.4
	Maximum	11.4
Coefficient of variation (s%)	11.03	9.57

Fig. 3. Distribution of the winter wheat genotypes studied for protein content (Turda, 2014)

11, T.54-01, T.65-11. The variability parameters for wet gluten content (Table 3) obtained at 100 winter wheat genotypes studied in the year 2014, at A.R.D.S. Turda indicated, as for the protein content, that the average for the genotypes grown in normal conditions (19.49%) was lower than the average recorded for genotypes under chemical stress (26,23%).

In the case of genotypes untreated with NaClO_3 the range of variation for wet gluten content was 23.1 percent with limits between 9.9 and 33%. The value of standard deviation (5.41) indicated that the experimental results don't have values around their average.

The wet gluten content for chemical desicated genotypes was between 17.6 and 40.6 percent with a range of variation of 23. For these ones, standard deviation shows that the wet

gluten content, in most analyzed genotypes, have values close to the average.

The coefficient of variation for chemical desicated genotypes (20.62) indicated high variability of statistical repartition while the the coefficient of variation for the genotypes without treatment shows a medium variability of the experimental values.

The distribution of winter wheat genotypes studied for wet gluten content (Fig. 4) shows that in dry conditions, only 12 of the analyzed genotypes have a wet gluten content close to the average with values between 24.95- 27.95% while in normal condition, most of them (43) had wet gluten content between 18.93-21.93%, close to the average of all 100 genotypes studied.

Among the 10 genotypes with the highest wet gluten content (Table 4) are found varieties but

Tab. 2. Winter wheat genotypes with the highest protein values from the ARDS Turda (Turda, 2014)

Rank	Treated with NaClO_3		Untreated	
	Genotypes	Protein content (%)	Genotypes	Protein content (%)
1	GK. Kalasz	13.7	Apullum	11.4
2	T 265- 01	13.4	T.265- 01	11.4
3	Gruia	13.1	Capo	10.8
4	Pitar	13.0	Aniversar	10.3
5	Apullum	12.9	T.126- 11	10.0
6	Aniversar	12.4	T 54- 01	9.9
7	Bezostaia	12.4	T.65- 11	9.9
8	Josef	12.0	Rovine	9.8
9	Serina	11.9	Bezostaia	9.7
10	T.23- 12	11.9	GK. Kalasz	9.5

Tab. 3. Wet gluten content parameters variability for 100 winter wheat genotypes studied at A.R.D.S. Turda in the year 2014

	Ash content (%) (Turda, 2014)	
	Treated	Untreated
Statistical population	100 genotypes	100 genotypes
Mean	26.23	19.49
Standard deviation	5.41	3.85
Skewness	0.32	0.63
Range of variation	23	23.1
Range of variation	Minimum	9.9
	Maximum	33
Coefficient of variation (s%)	20.62	19.75

also perspective lines of winter wheat genotypes. Apullum, Rovine, Bezostaia, Glosa, Josef and Gk. Kalasz have high content of wet gluten when are grown in normal conditions. After chemical desiccation, Gk. Kalasz has the highest value for wet gluten content (40.6).

In dry conditions, all 10 genotypes presented in the Table 4 have values of wet gluten content highest than 33%. Based on the ash content of flours can be achieved classification according to quality classes.

Considering the ash content of the 100 analyzed genotypes we observed that average of

desicated genotypes is 1.70% and the range of variation is 2.08% with values between 0.42% and 2.5. Standard deviation (0.45) indicating that the experimental values are far from the average for ash content.

The coefficient of variation (26.47) shows a large variability of the statistical repartitions. In the case of untreated genotypes we can observe a smaller medium value for ash content, with 0.52%, than in the treated genotypes.

The range of variation for 100 winter wheat genotypes is 2.31 with values between 0.22 and

Fig. 4. Distribution of the winter wheat genotypes studied for wet gluten content (Turda, 2014)

Tab. 4. Winter wheat genotypes with the highest protein values from the ARDS Turda (Turda, 2014)

Rank	Treated with NaClO ₃		Untreated	
	Genotypes	Protein content (%)	Genotypes	Protein content (%)
1	GK. Kalasz	40.6	Apullum	33
2	Apullum	37.2	T.265- 01	29.4
3	Pitar	36.8	Rovine	28.7
4	T.265- 01	35.9	Capo	28.5
5	Gruia	35.4	T.126- 11	26.4
6	Delabrad	35.2	Bezostaia	26.2
7	Josef	34.8	Glosa	25.4
8	Exotic	34.1	T.124- 11	24.6
9	Glosa	33.9	Josef	24.5
10	Pratener	33.8	GK. Kalasz	23.6

2.53. The coefficient of variation (33.05) shows a very large variability of statistical data.

The distribution of winter wheat genotypes studied for ash content (Fig. 5) reveals that most of the untreated genotypes have an ash content between 1.27-1.47% and the majority of genotypes with chemical desiccation have values for ash content between 1.90- 2.10%. First 10 genotypes with highest ash content (Tab. 5) shows that desiccated genotypes have higher values for ash content than genotypes grown in normal conditions.

In the table below (Tab. 6) are found productions achieved for 10 of genotypes identified as terms of quality superior in the year 2014. The highest yield was achieved by *Glosa* variety with 10,660 kg/ha, with a rate of reduction after desiccation of 32.05.

Bezostaia variety used as check in terms of quality had the lowest production for untreated variant (6,615 kg/ha). It was affected by chemical stress caused after flowering achieving, in this case, production of 2,860 kg/ha with a rate of reduction of 56.77%.

Tab. 5. Ash content parameters variability for 100 winter wheat genotypes studied at A.R.D.S. Turda in the year 2014

	Ash content (%) (Turda, 2014)	
	Treated	Untreated
Statistical population	100 genotypes	100 genotypes
Mean	1.70	1.18
Standard deviation	0.45	0.39
Skewness	-0.70	0.47
Range of variation	2.08	2.31
Range of variation	Minimum	0.22
	Maximum	2.53
Coefficient of variation (s%)	26.47	33.05

Fig. 5. Distribution of the winter wheat genotypes studied for ash content (Turda, 2014)

Tab. 5. Winter wheat genotypes with the highest ash values from the ARDS Turda (Turda,2014)

Rank	Treated with NaClO ₃		Untreated	
	Genotypes	Protein content (%)	Genotypes	Protein content (%)
1	T 265- 01	2.5	Capo	2.53
2	Josef	2.48	T 265- 01	2.46
3	Pitar	2.46	Apullum	2
4	Bezostaia	2.41	Josef	1.92
5	GK. Kalasz	2.39	Rovine	1.92
6	T.23- 12	2.36	Element	1.83
7	Delabrad	2.31	Bezostaia	1.74
8	Gruia	2.29	T.126- 11	1.7
9	Kolo	2.23	GK. Kalasz	1.65
10	T. 208- 11	2.19	Turda 95	1.62

Tab. 6. Production for 10 winter wheat varieties studied at A.R.D.S. Turda (Turda 2014)

Rank	Genotypes	Production for untreated genotypes (kg/ha)	Production for desiccated genotypes (kg/ha)	Rate of reduction (%)
1	Glosa	10,660	7,243	32.05
2	Josef	10,110	4,396	56.52
3	Pitar	9,912	6,326	36.18
4	Gruia	9,695	6,638	31.53
5	Flamura 85	9,544	5,744	39.82
6	Rovine	9,502	6,429	32.34
7	GK. Kalasz	9,443	6,736	28.67
8	Apullum	9,011	5,381	40.28
9	Aniversar	7,612	3,660	51.92
10	Bezostaia	6,615	2,860	56.77

CONCLUSIONS

Genotypes desiccation, 2 weeks after flowering, has affected both in terms of quality and in terms of production.

Apullum and Aniversar varieties had a protein content higher than 10% in normal conditions and over 12% in dry conditions. We also recomand for breeding programs in terms of protein content to use as genitors varieties like Capo, Rovine, GK. Kalasz, Bezostaia but also lines like: T.265-01, T.126-11, T.54-01, T.65-11.

Apullum, Rovine, Bezostaia, Glosa, Josef and Gk. Kalasz have high content of wet gluten when are grown in normal conditions. After chemical desiccation, Gk. Kalasz has the highest value for wet gluten content (40.6). In dry conditions, all 10 genotypes presented in the Table 4 have values of wet gluten content highest than 33%.

First 10 genotypes with highest ash content shows that desiccated genotypes have higher values for ash content than genotypes grown in normal conditions.

The highest yield was achieved by Glosa variety with 10,660 kg/ha, with a rate of reduction after desiccation of 32.05. Bezostaia variety used as check in terms of quality had the lowest production for untreated variant (6,615 kg/ha). It was affected by chemical stress caused after flowering achieving, in this case, production of 2,860 kg/ha with a rate of reduction of 56.77 percent.

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