Study of Winter Wheat Yield Quality Analysis at ARDS Turda

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ABSTRACT

The purpose of this research is to study the potential for yield and quality indicators for winter wheat genotypes in terms of pedological and climate condition and applied technology, at ARDS Turda during 2014 – 2015. Depending on the climatic conditions that are associated with applied technology is a decisive factor in successful wheat crop for all genotypes that were studied at ARDS Turda during the 2014 – 2016. That's why each genotype responded differently to the conditions of the ARDS Turda also through the two levels of fertilisations applied in the winter with fertilizers 20:20:0, 250 kg/ha assuring 50 kg/ha N and P active substance and second level of fertilisations with 150 kg/ha ammonium nitrate assuring 50 kg/ha N active substance. All genotype that were studied in terms of yield and quality indicators were influenced by the fertilization level. The influence of pedo-climatic conditions, applied technologies and fertilizers level at ARDS Turda showed that all genotypes with small yield had higher protein and gluten content respectively Zeleny index.

Keywords: *climate condition, quality, winter wheat, yield.*

INTRODUCTION

Wheat is one of the most important food plants, food accounted for 35-40 % of world population. Wheat quality is phenotypic expression of genotype interaction with environmental conditions and crop technology (Săulescu, 1984; Kadar *et al.*, 1999, 2002). The value of a variety of winter wheat is given by its high capacity production associated with the best quality, but a very important factor is the stability of production especially in terms of adverse climatic factors (Racz *et al.*, 2014). Choosing genotypes depending on the area or climatic conditions associated with applied technology are critical factors in the success of the wheat crop both in terms of production and quality (Ceclan *et al.*, 2015)

Production capacity is a complex and determined by intrinsic factors or external factors influence (Ceapoiu, 1974, 1984). The main means of obtaining high stable yields is also the most dynamic factor in the use of crop varieties and hybrids of high productivity (Ceapoiu *et al.*, 1984).

MATERIALS AND METHODS

The research was conducted during 2014 - 2015 in the experimental field of the Winter wheat breeding Laboratory from ARDS Turda on soil type mold cambic, vertic (faeoziom S.R.T.S. 2003) with a succession of horizons Am→Bvy→C or Cca silty loam / clay, hard, made against a background of clay marl lithology inflated with an external drain very slowly and low permeability. The ARDS Turda is situated in the north-east of Turda, 3 km from the highway E60 and 30 km from the city of Cluj Napoca. The thermal regime is characterized by average annual air of 8.6 °C, the warmest being July with average monthly temperature of 19.3° C, while the coldest month is January with average monthly temperature -4.4° C. Average annual rainfall of 556 mm, being the wettest on June, when 80.6 mm fell on average and the driest in February when it has averaged only 18.2 mm.

Experience with winter wheat genotypes from ARDS Turda included a wide range of Romanian and foreign genotypes created in the following centers:

ARDS Turda: Arieșan (var. ferrugineum), APULLUM (erythrospermum), TURDA 2000 (erythrospermum), DUMBRAVA (erythrospermum), ANDRADA (var. ferrugineum, fig. 4);
 INCDA Fundulea: DELABRAD (eryth.), FAUR (eryth.), GLOSA (eryth.), MIRANDA (eryth.), PITAR (eryth.);
 Oradea: CRIȘANA (eryth.);
 ARDS Suceava: MAGISTRAL (eryth.);
 ARDS Lovrin: LOVRIN 34 (eryth.);
 Austria: CAPO (eryth.), JOSEF (eryth.); GALIO (eryth.), FULVIO (eryth.);
 Hungary: BERES (eryth.); MV. KOLO (eryth.);
 France: RENAN (eryth.), APACHE (lutescens), ARLEQUIN (lutescens), Cristina (eryth.), Element (eryth.);
 Germany (KWS): EXOTIC (eryth.)

Before sowing wheat grains were treated with Dividend 1 l/tonn, against seed-borne diseases such as *Tilletia* spp. and *Fusarium*. Sowing was done individually for each variant in plots of 7 m² and the harvestable of 5 m². Fertilization was performed in two steps: In first were applied fertilizer 20: 20: 0 on all plots at a dose of 250 kg/ha to provide 50 kg/ha nitrogen and phosphorus active substance in winter on frozen on December 8. 2014. In the second step were applied to the supplementary fertilization 150 kg/ha of ammonium nitrate, to provide 50 kg/ha nitrogen active substance. The statistical processing of the experimental results was done by analysis of variance based on Fisher criterion (sample F) and Duncan test. It was determined the protein content, the wet gluten and Zeleny index performed by using INFRAGRAIN 9500 analyzer.

RESULTS AND DISCUSSION

Tab. 1 presents the analysis of variance in bifactorial experience (2x25) placed after the subdivided parcels method in three repetitions, is found by applying the criterion of Fisher that among the factors studied, the greatest influence on the yield of winter wheat has fertilization ($F = 284,247$), followed by genetic factor ($M = 128.662$) is important to mention FxS interaction ($F = 2.019$).

In Tab. 2 shows the influence of fertilization on the production of winter wheat varieties such variant that additional nitrogen was applied yielded an average production of 893 kg / ha higher than the version N50P50.

The first three places after the yields obtained lies in this order: Apache (France) Dumbrava (Romania) Exotic (Germany). In this experience were taken into account differences from two witnesses: Arieșan variety and average yields of all varieties (Tab. 3).

The winter wheat genotypes react differently to fertilization, the yield increases between 403 and 1565 kg/ha (Tab. 4), noting among these kinds Dumbrava which were obtained 10060 kg/ha in variant N1 100 kg/ha N to and 8778 kg/ha in variant N 2 to 50 kg/ha N active substance.

Year of 2015 was favorable for the manifestation of the production potential of winter wheat varieties tested, but was weak in terms of the quality of the crops in almost all varieties. Analysis of variance for protein content (Tab. 5) indicates that this index assessing the quality of wheat is largely influenced by genotype and And the sample F shown indicates that there are genetic differences between the varieties in terms of protein content.

Fertilization, especially with nitrogen contribute significantly to achieving good quality for grain, containing appropriate protein for baking industry. In 2015 at ARDS Turda was obtained from the average protein content of 9.51% based on the first level of fertilizer, which increases to 10.23% at the dose of 100 kg/ha N active substance (Tab. 6).

Protein content varied between 10.70% (MV. Kolo) and 8.83% (Arlequin) and Duncan test allowed a classification of varieties of this view in six graded as follows:

Class I (a): Mv Kolo, Cristina and Ariesan (10.63 to 10.70%);

Class II (ab and abc): Renan, Josef Beres, containing between 10.35 and 10.47%;

Class III (abcd, bcde, cdef): Fulvio, Stone, Turda 2000 Delabrad, Element, Glos Capo (10.00 to 10.18%); Clasa IV (defg, cdef, cde): Exotic, Crișana, Lovrin 34, Andrada, Apullum, Miranda, Galio (9.58-9.78);

Class V (hi, hi): Faur and Magistral (9.33 to 9.38%);

Class VI (ij, j): Apache, Dumbrava and Arlequin.

Most varieties were classified in classes III and IV for quality (Tab. 7), having a protein content of between 9.58 and 10.18%.

The results obtained from the Arieșan variety the protein content in 2015 averaged 11.47% in additional variant fertilized with nitrogen and 9.80% in the variant N50 (Tab. 8). The reaction to the fertilizer varieties of winter wheat tested in

Tab. 1. Analysis of variance and F sample for the polifactorial experience (2x25) with winter wheat varieties of for grain yield (q / ha), at ARDS Turda, 2015

Variation source	Square sum	GL	Square mean	F	Signf.
Fertilization (F)	2991,149	1	2991,149	284,257	***
Genotype (G)	3075,196	24	128,133	128,662	***
F x G	315,775	24	13,157	2,019	**
Repetions (R)	20,043	2	10,021		
FxR	21,045	2	10,522		
GxR	339,894	48	7,081		
FxGxR	285,721	48	5,952		
Errorr F	21,045	2	10,522		
Errorr G	625,615	96	6,516		
Total	7048,824	149			

Tab. 2. Influence of fertilization on yield (q / ha) for winter wheat varieties at ARDS Turda, 2015

Variant	Symbol	Yield (q/ha)	Yield (%)	Diff to F1 (q/ha)	Signif.	Duncan
N100P50	F1	90,72	100,0	0,00	Mt.	a
N50P50	F2	81,79	90,2	-8,93	00	b
LSD p 5%		DS 5%		2,28		2,28
LSD p 1%				5,26		
LSD p 0,1%				16,74		

Tab. 3. The influence of genotype on yield (q/ha) for winter wheat varieties at ARDS Turda, 2015

Variant	Symbol	Yield (q/ha)	Yield (%) Genotype mean	Yield(%) S1 Arieșan	Diff to S1 (q/ha)	Diff. to genotype mean (q/ha)
ARIESAN	S1	86.74	100.6	100.0	0.00 (Mt)	0.48
APULLUM	S2	83.35	96.6	96.1	-3.390	-2.91
TURDA 2000	S3	83.96	97.3	96.8	-2.78	-2.29
DUMBRAVA	S4	94.19	109.2	108.6	7.45***	7.93***
ANDRADA	S5	87.46	101.4	100.8	0.72	1.21
DELABRAD	S6	82.04	95.1	94.6	-4.7000	-4.2200
FAUR	S7	89.06	103.3	102.7	2.32	2.81
GLOSA	S8	83.10	96.3	95.8	-3.640	-3.160
MIRANDA	S9	86.28	100.0	99.5	-0.46	0.02
PITAR	S10	84.82	98.3	97.8	-1.92	-1.44
JOSEF	S11	82.61	95.8	95.2	-4.1300	-3.640
RENAN	S12	84.16	97.6	97.0	-2.58	-2.09
CAPO	S13	84.01	97.4	96.9	-2.73	-2.25
APACHE	S14	95.62	110.9	110.2	8.88***	9.36***
ARLEQUIN	S15	91.35	105.9	105.3	4.61**	5.09***
EXOTIC	S16	93.59	108.5	107.9	6.85***	7.34***
MV. KOLO	S17	79.34	92.0	91.5	-7.40 000	-6.91000
CRISTINA	S18	78.89	91.5	90.9	-7.85 000	-7.37000
ELEMENT	S19	85.34	98.9	98.4	-1.41	-0.92
BERES	S20	80.72	93.6	93.1	-6.02 000	-5.54000
GALIO	S21	88.77	102.9	102.3	2.03	2.51
FULVIO	S22	86.63	100.4	99.9	-0.11	0.38
MAGISTRAL	S23	94.20	109.2	108.6	7.46***	7.94***
LOVRIN 34	S24	84.58	98.1	97.5	-2.16	-1.68
CRIȘANA	S25	85.58	99.2	98.7	-1.16	-0.67
Genotype mean		86.26	100.0			0.00 (Mt)
LSD 5% 2.92 LSD 1% 3.88 LSD 0.1% 5.00						

Tab. 4. Influence of fertilization on yield (q/ha) for winter wheat varieties at SCDA Turda, 2015

Variant	Symbol	N1=100 kg/ha N s.a.				N2=50 kg/ha N s.a.				Yield diff. (kg/ha) N1-N2
		Yield (q/ha)	(%)	Diff. S1 q/ha	Signif.	Yield (q/ha)	(%)	Diff. S1 q/ha	Signif.	
ARIESAN	S1	91.05	100.0	0.00	Mt.	82.43	100.0	0.00	Mt.	862
APULLUM	S2	89.61	98.4	-1.44	-	77.09	93.5	-5.34	0	1252
TURDA 2000	S3	87.54	96.1	-3.51	-	80.39	97.5	-2.05	-	715
DUMBRAVA	S4	100.60	110.5	9.55	***	87.78	106.5	5.35	*	1282
ANDRADA	S5	91.88	100.9	0.84	-	83.04	100.7	0.61	-	884
DELABRAD	S6	85.04	93.4	-6.01	00	79.04	95.9	-3.39	-	600
FAUR	S7	92.50	101.6	1.45	-	85.63	103.9	3.19	-	687
GLOSA	S8	90.92	99.9	-0.12	-	75.27	91.3	-7.16	000	1565
MIRANDA	S9	89.30	98.1	-1.75	-	83.26	101.0	0.83	-	604
PITAR	S10	90.58	99.5	-0.47	-	79.05	95.9	-3.38	-	1153
JOSEF	S11	88.07	96.7	-2.98	-	77.16	93.6	-5.27	0	1091
RENAN	S12	88.14	96.8	-2.91	-	80.19	97.3	-2.24	-	795
CAPO	S13	89.21	98.0	-1.83	-	78.80	95.6	-3.63	-	1041
APACHE	S14	101.03	111.0	9.98	***	90.21	109.4	7.78	***	1109
ARLEQUIN	S15	96.94	106.5	5.90	**	85.76	104.0	3.32	-	1078
EXOTIC	S16	97.54	107.1	6.49	**	89.65	108.8	7.21	***	789
MV. KOLO	S17	85.06	93.4	-5.99	00	73.63	89.3	-8.80	000	1143
CRISTINA	S18	83.09	91.3	-7.96	000	74.69	90.6	-7.74	000	840
ELEMENT	S19	87.63	96.3	-3.41	-	83.04	100.7	0.60	-	459
BERES	S20	82.76	90.9	-8.29	000	78.68	95.4	-3.75	-	408
GALIO	S21	94.08	103.3	3.03	-	83.46	101.2	1.03	-	1062
FULVIO	S22	88.65	97.4	-2.40	-	84.62	102.7	2.19	-	403
MAGISTRAL	S23	97.39	107.0	6.35	**	91.00	110.4	8.57	***	639
LOVRIN 34	S24	90.15	99.0	-0.90	-	79.01	95.8	-3.42	-	1114
CRIȘANA	S25	89.30	98.1	-1.75	-	81.87	99.3	-0.57	-	743

LSD 5% - 4,14; LSD 1% - 5,48; LSD 0,1% - 7,07

Tab. 5. Analysis of variance and F sample for the polifactorial experience (2x25) with winter wheat varieties of for protein (%), at ARDS Turda, 2015

Variation source	Square sum	Liberty degrees	Mean Square	Proba F	Signif.
Fertilization (F)	19,512	1	19,512	192,680	***
Genotype (G)	39,937	24	1,664	16,174	***
F x G	9,639	24	0,401	3,904	**
Repetions (R)	1,253	2	0,626		
FxR	0,202	2	0,101		
GxR	3,556	48	0,074		
FxGxR	6,320	48	0,131		
Ererr F	0,202	2	0,101		
Ererr G	9,877	96	0,102		
Total	80,422	149			

Tab. 6. Influence of fertilization on protein content for winter wheat varieties at ARDS Turda, 2015

Variant	Symbol	Protein	(%)	Diff to F ₁ (%)	Signif.	Duncan
N ₁₀₀ P ₅₀	F ₁	10,23	100,0	0,00	Mt.	a
N ₅₀ P ₅₀	F ₂	9,51	92,8	-0,72	00	b
DL p 5%	DS 5%			0,22		
DL p 1%				0,52		0,22
DL p 0,1%				1,64		

Tab. 7. The influence of genotype to protein content (%) for winter wheat at ARDS Turda, 2015

Variant	Simbol	Protein	(%)	Diff to S_1 (%)	Signif	Duncan
ARIESAN	S_1	10,63	100,0	0,00	Mt.	a
APULLUM	S_2	9,62	90,4	-1,02	000	fgh
TURDA 2000	S_3	10,08	94,8	-0,55	00	bcde
DUMBRAVA	S_4	8,92	83,9	-1,72	000	j
ANDRADA	S_5	9,63	90,6	-1,00	000	fgh
DELABRAD	S_6	10,02	94,2	-0,62	00	cdef
FAUR	S_7	9,38	88,2	-1,25	000	ghi
GLOSA	S_8	10,00	94,0	-0,63	000	cdef
MIRANDA	S_9	9,58	90,1	-1,05	000	fgh
PITAR	S_{10}	10,17	95,6	-0,47	0	bcd
JOSEF	S_{11}	10,40	97,8	-0,23	-	abc
RENAN	S_{12}	10,47	98,4	-0,17	-	ab
CAPO	S_{13}	10,00	94,0	-0,63	000	cdef
APACHE	S_{14}	9,02	84,8	-1,62	000	ij
ARLEQUIN	S_{15}	8,83	83,1	-1,80	000	j
EXOTIC	S_{16}	9,78	92,0	-0,85	000	defg
MV. KOLO	S_{17}	10,70	100,6	0,07	-	a
CRISTINA	S_{18}	10,65	100,2	0,02	-	a
ELEMENT	S_{19}	10,02	94,2	-0,62	00	cdef
BERES	S_{20}	10,35	97,3	-0,28	-	abc
GALIO	S_{21}	9,58	90,1	-1,05	000	fgh
FULVIO	S_{22}	10,18	95,8	-0,45	0	bcd
MAGISTRAL	S_{23}	9,33	87,9	-1,30	000	hi
LOVRIN 34	S_{24}	9,65	90,8	-0,98	000	fgh
CRİȘANA	S_{25}	9,72	91,4	-0,92	000	efgh
DL p 5%	DS 5%			0,37		
DL p 1%				0,49		
DL p 0,1%				0,63		

conditions of 2015 at ARDS Turda was different in terms of protein content, allowing identification of varieties very productive, as Arlequin which yielded low levels on both levels fertilization. Ariesan varieties and Glosa react best to nitrogen fertilization, yielding values of 1.67 and 1.87% higher at N100 variant compared to N50.

The results obtained in 2015 showed a strong influence on the wet gluten content of factors: fertilization and variety, and the interaction between them (Tab. 9).

By increasing the dose of nitrogen to obtain an increase in wet gluten content of winter wheat varieties in 2015 was 1.16% in variant N1 (100 kg/ha N) compared to N2 (50 kg/ha N), as shown by the data presented in Tab. 10.

Using for control the variety Arieșan we observe that the wet gluten content that it was surpassed only by three genotypes, namely: Beres, Cristina and MV. Kolo (Tab. 11).

After wet gluten content values obtained the studied varieties could be grouped as follows:

- > 21% Beres;
- 20.1-21%: Capu, Renan, Josef, Arieșan, MV. Kolo, Cristina;
- 19.1-20 %: Element, Delabrad, Turda 2000, Pitar, Fulvio, Glosa;
- 18.1-19 %: Crișana, Faur, Andrada, Lovrin 34, Exotic, Apullum, Galio;
- 17.1-18 %: Apache, Magistral, Miranda;
- 16.1-17 %: Arlequin și Dumbrava

Tab. 8. Influence of fertilization on protein content (%) for winter wheat varieties at ARDS Turda, 2015

Variant	Symbol	N1=100 kg/ha N s.a.				N2=50 kg/ha N s.a.				Diff Protein (%) N1-N2
		Protein	(%)	Diff. S1%	Signif	Protein	(%)	Diff. S1%	Signif	
ARIESAN	S1	11.47	100.0	0.00	Mt.	9.80	100.0	0.00	Mt.	1,67
APULLUM	S2	10.13	88.4	-1.33	000	9.10	92.9	-0.70	00	1,03
TURDA 2000	S3	10.40	90.7	-1.07	000	9.77	99.7	-0.03	-	0,63
DUMBRAVA	S4	9.27	80.8	-2.20	000	8.57	87.4	-1.23	000	0,70
ANDRADA	S5	10.37	90.4	-1.10	000	8.90	90.8	-0.90	000	1,47
DELABRAD	S6	10.23	89.2	-1.23	000	9.80	100.0	0.00	-	0,43
FAUR	S7	9.63	84.0	-1.83	000	9.13	93.2	-0.67	0	0,50
GLOSA	S8	10.93	95.3	-0.53	0	9.07	92.5	-0.73	00	1,87
MIRANDA	S9	10.13	88.4	-1.33	000	9.03	92.2	-0.77	00	1,10
PITAR	S10	10.60	92.4	-0.87	00	9.73	99.3	-0.07	-	0,87
JOSEF	S11	10.77	93.9	-0.70	00	10.03	102.4	0.23	-	0,73
RENAN	S12	10.77	93.9	-0.70	00	10.17	103.7	0.37	-	0,60
CAPO	S13	10.57	92.2	-0.90	000	9.43	96.3	-0.37	-	1,13
APACHE	S14	9.27	80.8	-2.20	000	8.77	89.5	-1.03	000	0,50
ARLEQUIN	S15	8.87	77.3	-2.60	000	8.80	89.8	-1.00	000	0,07
EXOTIC	S16	9.87	86.0	-1.60	000	9.70	99.0	-0.10	-	0,17
MV. KOLO	S17	11.20	97.7	-0.27	-	10.20	104.1	0.40	-	1,00
CRISTINA	S18	11.10	96.8	-0.37	-	10.20	104.1	0.40	-	0,90
ELEMENT	S19	9.90	86.3	-1.57	000	10.13	103.4	0.33	-	0,23
BERES	S20	10.90	95.1	-0.57	0	9.80	100.0	0.00	-	1,10
GALIO	S21	9.70	84.6	-1.77	000	9.47	96.6	-0.33	-	0,23
FULVIO	S22	10.17	88.7	-1.30	000	10.20	104.1	0.40	-	0,03
MAGISTRAL	S23	9.47	82.6	-2.00	000	9.20	93.9	-0.60	0	0,27
LOVRIN 34	S24	10.10	88.1	-1.37	000	9.20	93.9	-0.60	0	0,90
CRISANA	S25	9.93	86.6	-1.53	000	9.50	96.9	-0.30	-	0,43

DL 5% - 0,52; DL 1% - 0,69; DL 0,1% - 0,89

Tab. 9. Analysis of variance and F sample for the polifactorial experience (2x25) with winter wheat varieties of for wet gluten (%), at ARDS Turda, 2015

Variation source	Square sum	Liberty degrees	Mean Square	F	Signif.
Fertilization (F)	50,344	1	50,344	58,264	***
Genotype (G)	242,609	24	10,109	56,203	***
F x G	29,810	24	1,242	6,906	***
Repetitions (R)	0,965	2	0,483		
FxR	1,728	2	0,864		
GxR	6,814	48	0,141		
FxGxR	10,451	48	0,217		
Error F	1,728	2	0,864		
Error G	17,266	96	0,179		
Total	342,724	149			

Tab.10. Influence of fertilization on wet gluten content for winter wheat varieties at ARDS Turda, 2015

Variant	Symbol	Wet gluten	(%)	Diff. to N ₁ (%)	Signif.	Duncan
N ₁₀₀ P ₅₀	F ₁	19,69	100,0	0,00	Mt.	a
N ₅₀ P ₅₀	F ₂	18,53	94,1	-1,16	0	b
DL p 5%	DS 5%			0,65		
DL p 1%				1,51		0,65
DL p 0,1%				4,80		

Tab. 11. The influence of genotype to wet gluten content (%) for winter wheat varieties at ARDS Turda, 2015

Variant	Symbol	Wet gluten	(%)	Diff. to S ₁ (%)	Signif.	Duncan
ARIESAN	S ₁	20,67	100,0	0,00	Mt.	ab
APULLUM	S ₂	18,65	90,2	-2,02	000	h
TURDA 2000	S ₃	19,38	93,8	-1,28	000	ef
DUMBRAVA	S ₄	16,50	79,8	-4,17	000	k
ANDRADA	S ₅	18,55	89,8	-2,12	000	h
DELABRAD	S ₆	19,37	93,7	-1,30	000	ef
FAUR	S ₇	18,37	88,9	-2,30	000	hi
GLOSA	S ₈	19,85	96,0	-0,82	00	cde
MIRANDA	S ₉	17,98	87,0	-2,68	000	ij
PITAR	S ₁₀	19,43	94,0	-1,23	000	ef
JOSEF	S ₁₁	20,62	99,8	-0,05	-	b
RENAN	S ₁₂	20,35	98,5	-0,32	-	bc
CAPO	S ₁₃	20,03	96,9	-0,63	0	cd
APACHE	S ₁₄	17,50	84,7	-3,17	000	j
ARLEQUIN	S ₁₅	16,33	79,0	-4,33	000	k
EXOTIC	S ₁₆	18,63	90,2	-2,03	000	h
MV. KOLO	S ₁₇	20,75	100,4	0,08	-	ab
CRISTINA	S ₁₈	20,78	100,6	0,12	-	ab
ELEMENT	S ₁₉	19,30	93,4	-1,37	000	fg
BERES	S ₂₀	21,18	102,5	0,52	*	a
GALIO	S ₂₁	18,83	91,1	-1,83	000	gh
FULVIO	S ₂₂	19,80	95,8	-0,87	000	def
MAGISTRAL	S ₂₃	17,82	86,2	-2,85	000	j
LOVRIN 34	S ₂₄	18,62	90,1	-2,05	000	h
CRISANA	S ₂₅	18,35	88,8	-2,32	000	hi
DL p 5%	DS 5%			0,49		
DL p 1%				0,64		0,49- 0,60
DL p 0,1%				0,83		

Tab.12. Influence of fertilization on wet gluten (%) for winter wheat varieties at ARDS Turda, 2015

Variant	Symbol	N ₁ =100 kg/ha N s.a.				N ₂ =50 kg/ha N s.a.				Diff. Wet gluten (%) N1-N2
		Wet gluten	(%)	Diff. S1 %	Signif.	Wet gluten	(%)	Diff. S1 %	Signif.	
ARIESAN	S ₁	22.57	100.0	0.00	Mt.	18.77	100.0	0.00	Mt.	3.80
APULLUM	S ₂	19.23	85.2	-3.33	000	18.07	96.3	-0.70	0	1.17
TURDA 2000	S ₃	20.00	88.6	-2.57	000	18.77	100.0	0.00	-	1.23
DUMBRAVA	S ₄	16.93	75.0	-5.63	000	16.07	85.6	-2.70	000	0.87
ANDRADA	S ₅	19.47	86.3	-3.10	000	17.63	94.0	-1.13	00	1.83
DELABRAD	S ₆	19.67	87.1	-2.90	000	19.07	101.6	0.30	-	0.60
FAUR	S ₇	18.63	82.6	-3.93	000	18.10	96.4	-0.67	-	0.53
GLOSA	S ₈	21.20	93.9	-1.37	000	18.50	98.6	-0.27	-	2.70
MIRANDA	S ₉	19.30	85.5	-3.27	000	16.67	88.8	-2.10	000	2.63
PITAR	S ₁₀	20.10	89.1	-2.47	000	18.77	100.0	0.00	-	1.33
JOSEF	S ₁₁	21.13	93.6	-1.43	000	20.10	107.1	1.33	***	1.03
RENAN	S ₁₂	21.13	93.6	-1.43	000	19.57	104.3	0.80	*	1.57
CAPO	S ₁₃	20.43	90.5	-2.13	000	19.63	104.6	0.87	*	0.80
APACHE	S ₁₄	17.63	78.1	-4.93	000	17.37	92.5	-1.40	000	0.27
ARLEQUIN	S ₁₅	16.67	73.9	-5.90	000	16.00	85.3	-2.77	000	0.67
EXOTIC	S ₁₆	18.87	83.6	-3.70	000	18.40	98.0	-0.37	-	0.47
MV. KOLO	S ₁₇	21.90	97.0	-0.67	-	19.60	104.4	0.83	*	2.30
CRISTINA	S ₁₈	21.57	95.6	-1.00	00	20.00	106.6	1.23	***	1.57
ELEMENT	S ₁₉	19.27	85.4	-3.30	000	19.33	103.0	0.57	-	0.07
BERES	S ₂₀	21.53	95.4	-1.03	00	20.83	111.0	2.07	***	0.70

Tab.12. (continued) Influence of fertilization on wet gluten (%) for winter wheat varieties at ARDS Turda, 2015

Variant	Symbol	N ₁ =100 kg/ha N s.a.				N ₂ =50 kg/ha N s.a.				Diff. Wet gluten (%) N1-N2
		Wet gluten	(%)	Diff. S1 %	Signif.	Wet gluten	(%)	Diff. S1 %	Signif.	
GALIO	S ₂₁	18.97	84.0	-3.60	000	18.70	99.6	-0.07	-	0.27
FULVIO	S ₂₂	19.90	88.2	-2.67	000	19.70	105.0	0.93	**	0.20
MAGISTRAL	S ₂₃	18.27	80.9	-4.30	000	17.37	92.5	-1.40	000	0.90
LOVRIN 34	S ₂₄	18.97	84.0	-3.60	000	18.27	97.3	-0.50	-	0.70
CRIȘANA	S ₂₅	18.80	83.3	-3.77	000	17.90	95.4	-0.87	0	0.90

DL 5% - 0,69; DL 1% - 0,91; DL 0,1% - 1,18

Tab. 13. Analysis of variance and F sample for the polifactorial experience (2x25) with winter wheat varieties of for Zeleny index (%), at ARDS Turda, 2015

Variation source	Square sum	Liberty degrees	Mean Square	F	Signif.
Fertilization (F)	820,872	1	820,872	73,947	***
Genotipe (G)	2769,065	24	115,377	70,213	***
F x G	531,579	24	22,149	13,479	***
Repetions (R)	9,000	2	4,500		
FxR	22,201	2	11,101		
GxR	46,569	48	0,970		
FxGxR	111,181	48	2,316		
Erorr F	22,201	2	11,101		
Erorr G	157,751	96	1,643		
Total	4310,470	149			

Tab.14. Influence of fertilization on Zeleny index for winter wheat varieties at ARDS Turda, 2015

Variant	Symbol	Zeleny (ml)	(%)	Diff. to N ₁ (%)	Signif.	Duncan
N ₁₀₀ P ₅₀	F ₁	27,27	100,0	0,00	Mt.	a
N ₅₀ P ₅₀	F ₂	22,59	82,8	-12,71	0	b
DL p 5%		DS 5%		2,34		2,34
		DL p 1%		5,40		
		DL p 0,1%		17,19		

The results obtained from ARDS Turda, 2015 us to say that after assessing the quality of wet gluten content is more objective than the one that is done after protein content. Some varieties can accumulate a higher protein content, but they are not quality.

Ariesan variety was the highest variation of wet gluten content in variant N1 (100 kg/ha N active substance) to N2 (50 kg/ha N active substance), which is 3.80% (Tab. 12).

Sedimentation method, developed by Zeleny is simple and rapid and is based on the swelling of gluten and sedimentation of the particles in acid medium. Stability Index shows a relatively

high sedimentation in different experimental conditions and is less influenced by environment.

As can be seen from Tab. 13 analysis of variance for Zeleny index, it is conditioned in a high proportion of genotype (SP = 2769.065), when referring to the sum of squares attributed to this factor, but it can be improved through fertilization (F = 73.947 **).

By increasing the dose of nitrogen to obtain an increase in sedimentation index for winter wheat varieties in 2015 with 4.68 ml on variant N1 (100 kg/ha N active substance) to N2 (50 kg/ha N active substance) as is apparent from the data presented in Tab. 14.

Tab. 15. The influence of genotype to Zeleny index (%) for winter wheat varieties at ARDS Turda, 2015

Variant	Symbol	Zeleny (ml)	(%)	Diff to S_1 (%)	Signif.	Duncan
ARIESAN	S_1	30.12	100.0	0.00	Mt.	bc
APULLUM	S_2	25.40	84.3	-4.72	000	gh
TURDA 2000	S_3	29.58	98.2	-0.53	-	cd
DUMBRAVA	S_4	19.70	65.4	-10.42	000	k
ANDRADA	S_5	23.17	76.9	-6.95	000	i
DELABRAD	S_6	25.10	83.3	-5.02	000	gh
FAUR	S_7	24.65	91.8	-5.47	000	h
GLOSA	S_8	26.65	88.5	-3.47	000	fg
MIRANDA	S_9	19.92	66.1	-10.20	000	k
PITAR	S_{10}	24.97	82.9	-5.15	000	gh
JOSEF	S_{11}	30.30	100.6	0.18	-	bc
RENAN	S_{12}	26.55	88.2	-3.57	000	fg
CAPO	S_{13}	27.42	91.0	-2.70	000	ef
APACHE	S_{14}	19.27	64.0	-10.85	000	k
ARLEQUIN	S_{15}	15.87	52.7	-14.25	000	l
EXOTIC	S_{16}	22.97	76.3	-7.15	000	i
MV. KOLO	S_{17}	31.43	104.4	1.32	-	b
CRISTINA	S_{18}	28.33	94.1	-1.78	0	de
ELEMENT	S_{19}	25.08	83.3	-5.03	000	gh
BERES	S_{20}	33.05	109.7	2.93	***	a
GALIO	S_{21}	24.67	81.9	-5.45	000	h
FULVIO	S_{22}	25.50	84.7	-4.62	000	gh
MAGISTRAL	S_{23}	16.82	55.8	-13.30	000	l
LOVRIN 34	S_{24}	25.37	84.2	-4.75	000	gh
CRIȘANA	S_{25}	21.45	71.2	-8.67	000	j
DL p 5% DS 5% 1,47 DL p 1% 1,95 DL p 0,1% 2,51						1,47-1,83

The data in Tab. 15 is that the variety Beres obtained the highest Zeleny index (sedimentation index) values 33,05 %, and Arieșan is not far from it 30,12 %.

The results are particularly important because emphasizes the importance of nitrogen fertilization to obtain yields with good quality indices, as in the case of sedimentation index. Of course there are varieties such as: Apache, Arlequin and Magistral that do not change regardless of the quality by the level of nitrogen fertilization, meaning that they are endowed with a potential low quality, genetically (Tab. 16).

CONCLUSION

The result of research is to test the response to fertilization of winter wheat variety released in

production, and behavior evaluation for Romanian winter wheat varieties compared to foreign ones.

To the 25 winter wheat varieties studied in at ARDS Turda result genetic differences in terms of production potential, indicated by the analysis of variance; and the highest level of production being obtained by the cultivars Apache (France) Dumbrava (Romania) Exotic (Germany).

Winter wheat genotypes react differently to fertilization, the yield increases between 403 and 1565 kg/ha, noting Dumbrava variety among them which were obtained from 10060 kg/ha in variant N1 100 kg / ha N active substance and 8778 kg/ha in variant N 2 to 50 kg/ha N active substance.

Fertilization, especially with nitrogen contribute significantly to achieving good quality for grain, containing appropriate protein for baking industry.

Tab. 16. Influence of fertilization on Zeleny index (%) for winter wheat varieties at ARDS Turda, 2015

Variant	Symbol	N ₁ =100 kg/ha N s.a.				N ₂ =50 kg/ha N s.a.				Diff Zeleny (ml) N1-N2
		Zeleny (ml)	(%)	Dif. S1 %	Signif	Zeleny (ml)	(%)	Dif. S1%	Signif	
ARIESAN	S ₁	34.83	100.0	0.00	Mt.	25.40	100.0	0.00	Mt.	9.43
APULLUM	S ₂	26.30	75.5	-8.53	000	24.50	96.5	-0.90	-	1.80
TURDA 2000	S ₃	30.53	87.7	-4.30	000	28.63	112.7	3.23	**	1.90
DUMBRAVA	S ₄	25.17	72.2	-9.67	000	14.23	56.0	-11.17	000	10.93
ANDRADA	S ₅	26.33	75.6	-8.50	000	20.00	78.7	-5.40	000	6.33
DELABRAD	S ₆	27.07	77.7	-7.77	000	23.13	91.1	-2.27	0	3.93
FAUR	S ₇	22.87	65.6	-11.97	000	26.43	104.1	1.03	-	3.57
GLOSA	S ₈	31.37	90.0	-3.47	00	21.93	86.4	-3.47	00	9.43
MIRANDA	S ₉	23.60	67.8	-11.23	000	16.23	63.9	-9.17	000	7.37
PITAR	S ₁₀	28.30	81.2	-6.53	000	21.63	85.2	-3.77	000	6.67
JOSEF	S ₁₁	32.83	94.3	-2.00	-	27.77	109.3	2.37	*	5.07
RENAN	S ₁₂	30.97	88.9	-3.87	000	22.13	87.1	-3.27	00	8.83
CAPO	S ₁₃	28.40	81.5	-6.43	000	26.43	104.1	1.03	-	1.97
APACHE	S ₁₄	19.70	56.6	-15.13	000	18.83	74.1	-6.57	000	0.87
ARLEQUIN	S ₁₅	18.30	52.5	-16.53	000	13.43	52.9	-11.97	000	4.87
EXOTIC	S ₁₆	25.00	71.8	-9.83	000	20.93	82.4	-4.47	000	4.07
MV. KOLO	S ₁₇	37.50	107.7	2.67	*	25.37	99.9	-0.03	-	12.13
CRISTINA	S ₁₈	31.93	91.7	-2.90	00	24.73	97.4	-0.67	-	7.20
ELEMENT	S ₁₉	26.53	76.2	-8.30	000	23.63	93.0	-1.77	-	2.90
BERES	S ₂₀	33.03	94.8	-1.80	-	33.07	130.2	7.67	***	0.03
GALIO	S ₂₁	25.17	72.2	-9.67	000	24.17	95.1	-1.23	-	1.00
FULVIO	S ₂₂	25.93	74.4	-8.90	000	25.07	98.7	-0.33	-	0.87
MAGISTRAL	S ₂₃	17.63	50.6	-17.20	000	16.00	63.0	-9.40	000	1.63
LOVRIN 34	S ₂₄	27.40	78.7	-7.43	000	23.33	91.9	-2.07	-	4.07
CRIȘANA	S ₂₅	25.10	72.1	-9.73	000	17.80	70.1	-7.60	000	7.30

DL 5% - 2,08; DL 1% - 2,75; DL 0,1% - 3,55

The reaction to the fertilizer varieties of winter wheat tested in conditions of 2015 at ARDS Turda was different in terms of protein content, allowing identification of varieties very productive, as Arlequin which yielded low levels on both levels fertilization.

The results obtained from the variety Arieșan the protein content in 2015 averaged 11.47% in additional variant fertilized with nitrogen and 9.80% in the variant N50.

In most varieties, quality achieved in 2015, appreciated by the wet gluten content is modest to low, values over 22% they have not registered to any studied variety.

After wet gluten content obtained at fertilization variant with 100 kg/ha N active substance

variety Arieșan occupying the first place, yielding differences compared to him statistically being distinct and very significant negative.

The results obtained in Turda in terms of quality indices obtained, us to say that 2015 was not favorable from this point of view, because lower values were obtained in all varieties. explanations for this are the rains that occurred in July and that caused washing gluten and its qualitative impairment.

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