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Climatic conditions influence on the variation of quality indicators of some Romanian and foreign winter wheat cultivars

Alda Liana[1*], Alda S.[2], Fora C.[2], Moigradean Diana[1], Gogoasa I.[1], Bordean D.[1], Cârciu G.[2], Cristea T.[2]

[1]USAMVB Timisoara, Faculty of Food Processing Technology; [2]USAMVB Timisoara, Faculty of Horticulture and Forestry

*Corresponding author E-mail: lianaalda@yahoo.com

Abstract Winter wheat variety evaluation will become increasingly important in the future. The introduction of new local and foreign varieties of winter wheat in the production requires ecological and qualitative knowledge of these cultivars grown in a certain area.The purpose of the researche is to monitoring the behavior of nine varieties of winter wheat: Element, Apache, Sorrial, Sobbel, Lovrin 34, SO-207, Ciprian, Soissons and Exotic.
The experimental field was placed in 2010 and 2011 in Banat County, on a cambic chernozem and the fertilisation level was $N_{120}P_{60}K_{60}$. Quality parameters that were folowed are: moisture, protein content, gluten content and Zeleny sedimentation index. Cultivated on a cambic chernozem (west of Romania), with a moderate fertilisation level ($N_{120}P_{60}K_{60}$), Element, Apache, Sorrial, Sobbel, Lovrin 34, SO-207, Ciprian and Exotic –all registered in 2012, a dry year, greater values of protein and gluten content than the values of this parameter registered in 2011.
The sedimentation index (Zeleny) was also influenced by climatic conditions. With the exception of Soisson and Lovrin 34, all the varieties registered in 2012 greater values of this parameter comparative with 2011 agricultural year.
Soissons was not positive influenced by the climatic conditions changes in 2012 and it registered the lowest quality parameters.

Key words

winter wheat cultivar, climatic conditions, protein content, gluten, sedimentation index

Globally, wheat is the leading source of vegetable protein in human food, having a higher protein content than either maize (corn) or rice, the other major cereals. In terms of total production tonnages used for food, it is currently second to rice as the main human food crop and ahead of maize, after allowing for maize's more extensive use in animal feeds[9]. Winter wheat variety evaluation will become increasingly important in the future.The introduction of new local and foreign varieties of winter wheat in the production requires ecological and qualitative knowledge of these cultivars grown in a certain area[2].
Winter wheat often suffers as a result of the climatic fluctuations[8]. Regarding the impact of temperature and humidity on quality parameters of winter wheat, variations in climatic conditions influences the accumulation of protein in grain and its quality[3]. The weather conditions during the growing season, especially the rainfall quantity and temperature, have a substantial influence on the plant metabolic processes, and thus on wheat quality. Stress during the grain-filling stage may have an even greater effect on wheat, as it may cause reduced grain-filling [4].
Protein content is the primary determinant for the use of new cultivars of winter wheat in baked goods.

Material and Method

Nine wheat varieties were used in this experience, 7 (Element, Apache, Sorrial, Sobbel, SO-207, Soissons, Exotic) of foreign origin and 2 (Lovrin 34 and Ciprian) of Romanian origin. The experience was placed on a cambic chernozem.The fertilisation level was $N_{120}P_{60}K_{60}$. The herbicide application was Buctril universal (bromoxynil+2,4-D)- 1l/ha. We used the OmegAnalyzer G device for the determinations, which is a German engineered whole grain and seed NIR analyser with pour through sample presentation for rapid analysis operating in the 730 nm to 1100 nm wavelength range.

Results and Discussions

The monthly temperature and the atmospherically precipitation recorded in 2010–2012, in winter wheat

vegetation period (1.10-31.07) are presented in Table 1 and 2.

The humidity of winter wheat cultivars registered after harvest in 2011 and 2012 is presented in Figure 1.

Regarding protein and gluten content (Figure 2 and 3) we observe that almost all the winter wheat cultivar registered in 2012, a dry year, better values of these parameters comparative with 2011 agricultural year, with the exception of Soisson who had a lower value (13.5%)of protein content comparative with the value(14.4%) corresponding the 2011 agricultural year. The greatest value of protein was registered in 2012 by Element (15.5%) and Ciprian (15.5%), followed by SO-207 (15.4), Lovrin 34 (14.7%) winter wheat cultivar.

Table 1

The monthly temperature recorded in 2010–2012, in winter wheat vegetation period

Month	*The monthly temperature* (ºC)		
	Multiannual mean	2010-2011 agricultural year	2011-2012 agricultural year
X	11.3	9.2	11.8
XI	5.6	8.5	-0.2
XII	1.4	2,0	3.5
I	-1.2	-0.4	0.7
II	0.4	-0.4	-5.9
III	6.0	6.7	7.1
IV	11.3	15.4	13.2
V	16.4	20.4	16.7
VI	19.6	26.7	22.1
VII	21.6	27.5	25.1

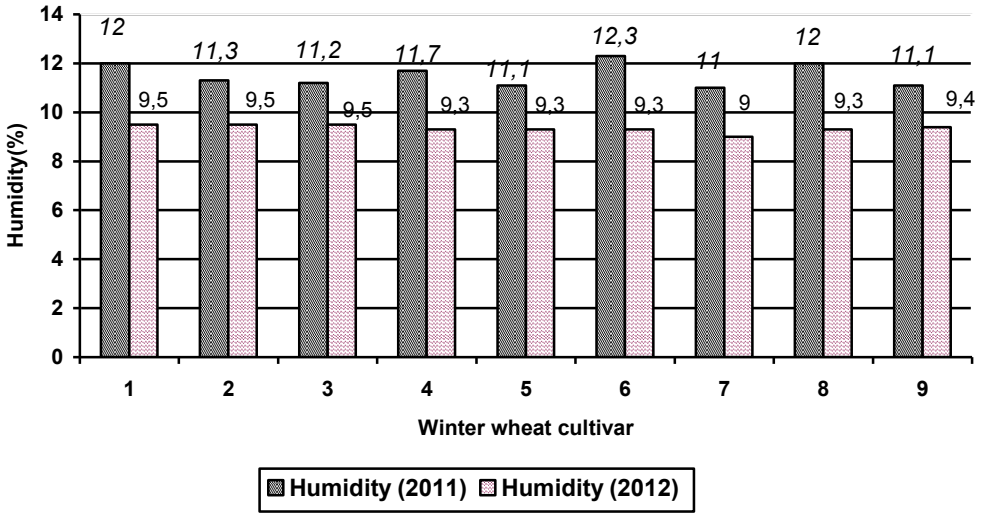
Table 2

The athmospherical precipitation recorded in 2010–2012, in winter wheat vegetation period

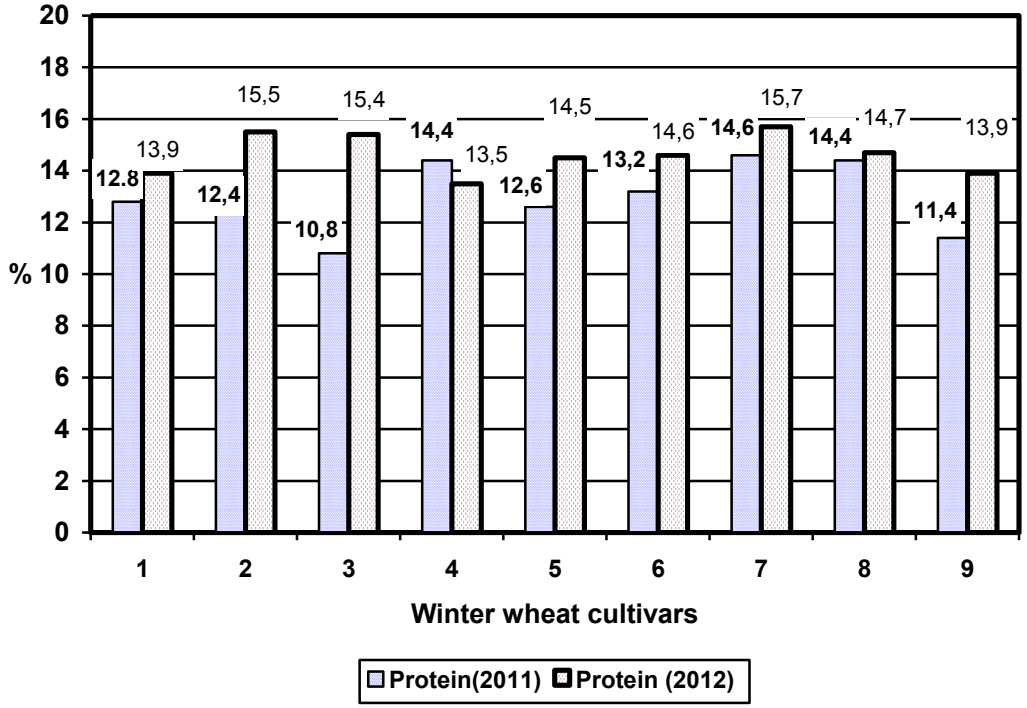
Month	*The monthly precipitations* (mm)		
	Multiannual mean	2010-2011 agricultural year	2011-2012 agricultural year
X	54.8	40.0	33.0
XI	48.6	50.2	0.0
XII	47.8	51.1	34.7
I	40.9	23.3	36.9
II	40.2	28.9	43.2
III	41.6	30.9	3.4
IV	50	21.9	105.2
V	66.7	67.3	55.5
VI	81.1	28.7	42.7
VII	59.9	107.9	86.7

SO-207 winter wheat cultivar had the lowest value (10.8%) of protein content in 2011 agricultural year.

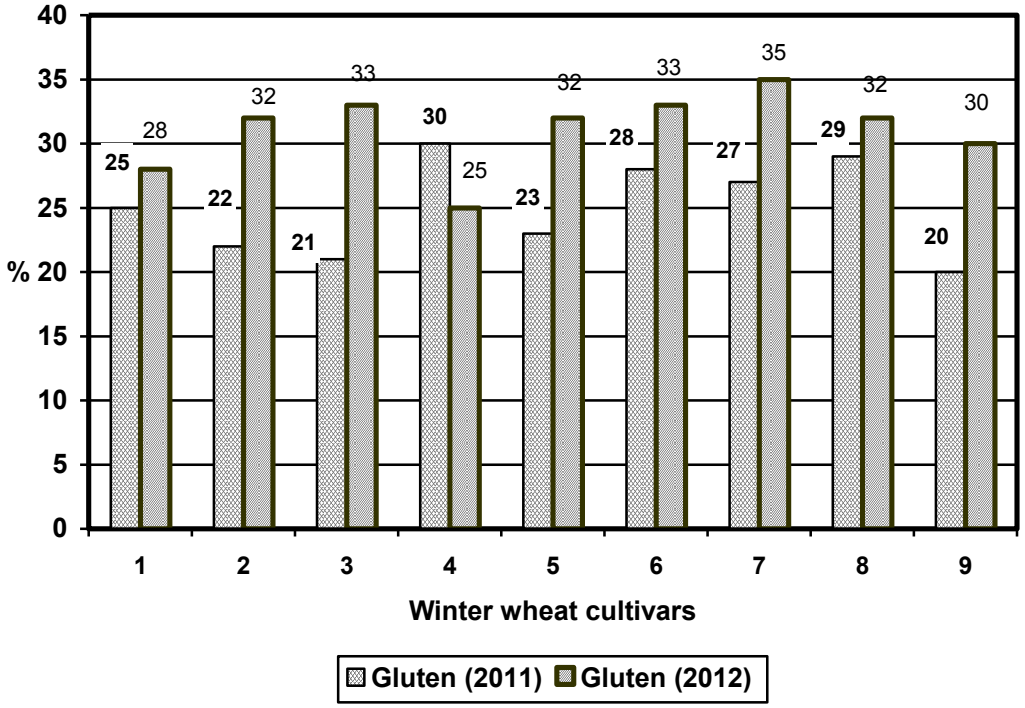
Regarding gluten content best results, in 2012, the Romanian cultivar Ciprian registered 35% gluten content, followed by SO-207 with 33%.



1-Apache; 2-Element; 3-SO-207; 4-Soissons; 5-Sorrial; 6-Exotic; 7-Ciprian; 8-Lovrin 34; 9-Sobbel.
Fig. 1. Graphical representation of the winter wheat grain humidity of 9 varieties

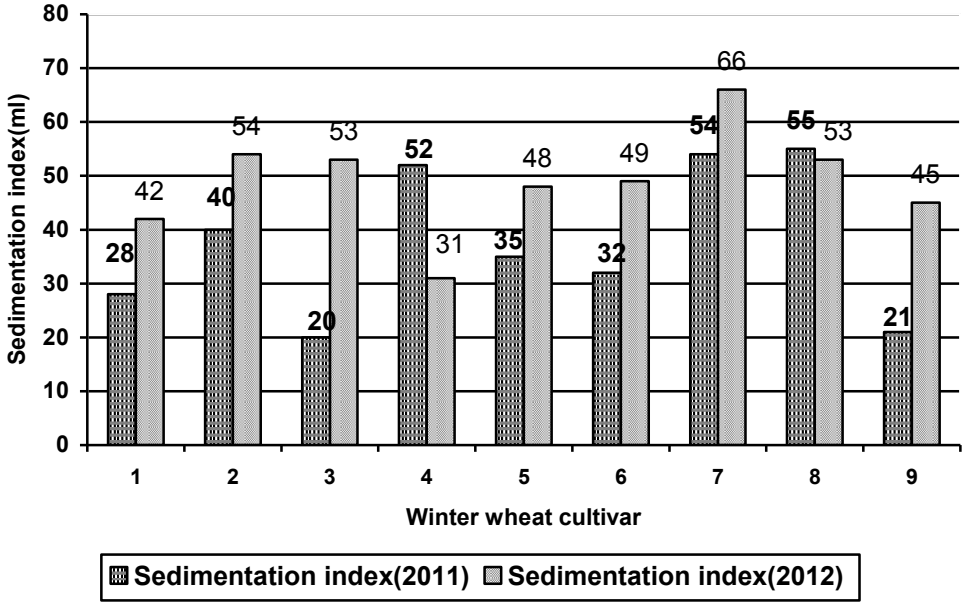


1-Apache; 2-Element; 3-SO-207; 4-Soissons; 5-Sorrial; 6-Exotic; 7-Ciprian; 8-Lovrin 34; 9-Sobbel.
Fig. 2. Graphical representation of the winter wheat grain proteins of 9 varieties



1-Apache; 2-Element; 3-SO-207; 4-Soissons; 5-Sorrial; 6-Exotic; 7-Ciprian; 8-Lovrin 34; 9-Sobbel.
Fig. 3. Graphical representation of the gluten content of winter wheat cultivars

Figure 4 gives the characteristics and performance regarding the sedimentation index (Zeleny) who was also influenced by the climatic conditions. With the exception of Soisson and Lovrin 34, all the varieties registered in 2012 greater values of this parameter comparative with 2011 agricultural year.



1-Apache; 2-Element; 3-SO-207; 4-Soissons; 5-Sorrial; 6-Exotic; 7-Ciprian; 8-Lovrin 34; 9-Sobbel.
Fig. 4. Graphical representation of Zeleny sedimentation index corresponding to the winter wheat cultivars

Conclusions

Cultivated on a cambic chernozem (west of Romania), under climatic conditions of the agricultural year 2011, with a moderate fertilisation level ($N_{120}P_{60}K_{60}$), Element, Apache, Sorrial, Sobbel, Lovrin 34, SO-207, Ciprian and Exotic –all registered in 2012, a dry year, greater values of protein and gluten content than the values of this parameter registered in 2011.

Soissons was not positive influenced by the climatic conditions changes and in 2012 it registered the lowest quality parameters.

With the exception of Soisson and Lovrin 34, all the varieties registered in 2012 greater values of sedimentation index (Zeleny).

Our results demonstrated that quality indices for winter wheat are strongly influenced by the climatic factor.

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