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RESEARCH REGARDING THE VARIETY IN OBTAINING HIGHER QUALITY WHEAT PRODUCTION, ON SANDY SOILS IN SOUTHERN OLTENIA, IN THE CONTEXT OF CLIMATE CHANGE

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Abstract

Wheat has a great importance as a food product, providing a large portion of carbohydrates and proteins necessary for man and more than half the calories consumed by humans.
Given the economic importance and special role it holds in human nutrition, basic trend now and in the future is to increase global production. In addition to this direction is emerging ever stronger and other trends, such as the introduction in production of varieties with a high content of protein with increased nutritional value and superior cultivation with baking qualities. Climate change last period of time with pronounced drought and even climate aridisation trend in southern Romania, led to increased frequency of drought years.
At CCDCPN Dabuleni in 2010-2012 were studied in terms of quality of grain, several varieties of winter wheat. Productivity and product quality are strongly influenced by abiotic limiting conditions (thermic and hydric stress) exhibited during the experiment.
The best production results were obtained in the climatic conditions of 2010, the varieties: Albota 69 (4133 kg/ha), Delabrad (4267 kg/ha), Glosa (4233 kg/ha) and Ciprian (4356 kg/ha) the production increases achieved statistically very significant.
Negative and significant correlation between wheat production and the number of days to gray, in conditions of droughty year, shows that precocity variety can be a measure that can contribute to mitigate effect drought and heat.
Protein content and wet gluten resulted in wheat grains gives a good quality of production: Delabrad (15.2% protein, 33.2% wet gluten), Boema (14.8% protein, 33.8% wet gluten), Glosa (14.9% protein, 31.4% wet gluten), etc..

Key words: *climate change, quality, variety, wheat.*

INTRODUCTION

Wheat is the most important cultivated plants, with great food weight. Having regard to the economic importance and special role it holds in human nutrition, the basic trend of now and in the future is of increasing global production. In addition to this direction is emerging increasingly stronger and other trends, such as the introduction in production of varieties with a high content of protein with enhanced nutritional value and superior cultivation of varieties with of bakery qualities.

Climate change in last period of time, with pronounced drought and even climate aridisation trend in southern Romania have led to increased frequency of drought years.

Variety represents an essential factor in the wheat culture technology in order to obtain constant and superior production quality, and this fact is even more evident during drought conditions.

Choosing varieties resistant to thermic and hydric stress conditions (drought, drought accompanied by heat) plays an important role in the fight against this phenomenon, in recent years more and more. Numerous studies highlights the differences between variety on the response to water shortage, as well as the difficulty of the merge a high production potential and features higher quality with good tolerance to drought (Blum, 1996; Mustatea et al., 2003; Olteanu and Tabara, 2008; Andronache, 2009; Idikut et al., 2009; Pasha et al., 2009; Voichita et al., 2010; Hrušková et al., 2012).

The present paper aims at behaviour some varieties of winter wheat in during 2010-2012 under the aspect of adaptability to climatic conditions, specific to areas of sandy soils of southern Oltenia manifested in the period the production test capacity and quality.

MATERIALS AND METHODS

Biological material studied consisted of 15 varieties of winter wheat: Flmura 85, Lovrin 34, Alex, Simnic, Albota, Boema, Crina, Delabrad, Dor, Faur, Glosa, Ciprian, Briana, Exotic, Capo.

The research was place in CCDCPN Dabuleni, during 2010-2012. Were made following observations and measurements:

- determined of protein: Perten method;
- determined of moisture-Perten method;
- determined of wet gluten-Perten method;
- determined of sedimentation Zeleny index Perten method;
- determined the MMB;
- determined MH;
- production (kg/ha).

The experimental results were processed by variance analysis and calculation of correlation coefficients (Saulescu, 1967).

RESULTS AND DISCUSSIONS

A complex area, in which we must improve the knowledge and understanding in order to take immediate and correct view to ensuring to obtain agricultural productions high performance it represents major climate change of our century.

Drought remains still an important abiotic stress factor that threatens agricultural production in many parts of the country, particularly in the south, the water becoming a scarce resource which requires economic and environmental management, conducted with great care. Climate change in recent years, have highlighted the clear trend of global warming and the intensification and expansion of droughts, with negative implications for crop plants. During the experiment included three different years in terms of water and temperature regime: 2010-rainy year, 2011-dry year and 2012 -very dry year (Table 1).

Table 1. Abiotic stress factors manifested in the vegetation period of winter wheat CCDCPN Dabuleni (2010-2012)

Stress factors	2010	2011	2012
Number of days with maximum temperature> 30 C^0 during May-June	13	11	25
Number of days with atmospheric humidity < 30% during May-June	3	17	20
S temperatures (C^0)	4048	3942	4612
The normal (C^0)	4099	4088	4136
Differences ± the normal (C^0)	-51	-146	+ 476
S rainfall (mm)	710	376	383.51
The normal (mm)	548	545	542.9
Differences ± the normal (mm)	+162	-169	-159.4
Characterization years	Rainy	Dry	Very dry

Table 2. The influence of variety on the nutritional quality of the grain of wheat production (2010-2012)

Variety	Moisture (%)	Proteine (%)	Index Zeleny (ml)	Gluten (%)	Hectoliter weight (kg/hl)	Weight of 1000 seeds (g)	Production	
							kg/ha	Significance
Flmura 85	12.8	16.5	68	38.2	74	44	2553	Mt.
Lovrin 34	12.7	15	63	35.4	72	43	3099	*
Alex	13.1	15.1	55	31.6	74	44	2905	-
Simnic	13.3	14.6	46	29.1	72	45	3026	-
Albota	12.5	15.3	57	33.8	73	43	3309	**
Boema	12	14.7	65	34.1	75	44	3308	**
Crina	12.7	15.3	53	31.7	75	45	3226	**
Delabrad	12.5	15.7	60	33.2	76	47	3586	***
Dor	13	15.8	58	33.5	76	42	2969	-
Faur	12.1	15.2	52	31.3	76	42	3422	**
Glosa	12.3	15.4	54	30.9	75	44	3692	***
Ciprian	12.7	15.5	60	33.1	73	46	3675	***
Briana	12.9	15.6	64	34.4	73	44	3442	**
Exotic	12.9	14.5	63	35.9	75	43	3501	**
Capo	12.6	17.7	72	39.3	74	41	3496	**
The average varieties	12.7	15.6	59	33.7	74	44	3280	*

LSD 5% = 544 kg/ha; LSD 1% = 733 kg/ha; LSD 0.1%=974 kg/ha

The year 2010 was characterized as a wet year, marking a higher amount of rainfall, with 162 mm of multiannual amount and frequency of days with temperatures >30°C and atmospheric humidity <30% are smaller, 13 days with hot temperatures and 3 days of heat.

The year 2011 can be characterized as a dry year due to higher frequency of days with temperatures >30°C(11 days), relative humidity <30% (17 days) and the total rainfall was 169 mm in multiannual rainfall amount. Drought was accompanied by heat, suffering a strong wheat plants water and temperature stress.

The year 2012 was a very dry year with 25 days with maximum temperature >30°C and 20 days with relative humidity <30%. Amount average temperature was above 476°C annual average and rainfall was 159 mm in the amount of multiannual.

The meteorological conditions during the experiment manifested reflected in production levels and quality of its stress factors (drought and heat) with different degrees of manifestation. The results on grain quality traits of wheat variety highlight influence on product quality in climatic conditions during the experiment. The amount of protein in grain presented different values depending on the varieties studied, and the climatic conditions in the area of culture. In wheat grains was determined average protein content of between 14.5% to Exotic variety and 17.7% at Capo variety, with an average of 15.6% (Table 2).

For bread wheat flour is preferred, with a minimum of 11% protein content. To obtain this flour, wheat must be at least 12% protein content, between 1-1.5% of wheat protein is lost in the transformation of its flour. All varieties studied showed a protein content greater than 12%. Varieties were observed: Capo variety (17.7%), Flamura 85 variety (16.5%), Delabrad variety (15.7%), Dor (15.8%), Briana variety (15.6%).

Grain moisture is also an important indicator of quality assessment. At harvest, the moisture should not exceed 15%, while maintaining optimal conditions is not performed until a moisture content below 14%. Studied varieties, grain moisture ranged from 12% to Boema variety and 13.3% to Simnic variety.

Wet gluten content in grain and sedimentation index Zeleny are very important quality indicators for the process, contributing to the characterization of dough, especially processing capacity and the potential for its baking. Values for these indicators fall wheat production obtained as very good. Varieties were observed: Flamura, Lovrin and Capo varieties gluten containing greater than 35%. Between gluten and Zeleny index was set a positive linear correlation with a highly significant correlation coefficient (r = 0.94 ***) (Figure 1).

Protein quality is given by sedimentation index. Sedimentation index Zeleny association with protein content is described by a regression of the rise, which shows that the sedimentation rate is proportional to the protein content. Also, the correlation between the amount of gluten and wheat grain protein is described by a regression, showing that gluten is directly proportional to the amount of protein in grain (Figure 2).

Averaged over the three years of experience in the production of wheat varieties studied ranged between 2558 and 3731 kg/ha (Table 2). The best behavior was variety Ciprian variety, who achieved 3731 kg/ha, exceeding the reference variety Flamura 85 variety distinct production with a significant increase of 1173 kg/ha. Also, good adaptability to the climatic conditions of the years of experimentation at CCDCPN Dabuleni and variety manifested Delabrad, Glossa, Briana, Exotic varieties, which exceeded the reference variety Flamura 85 variety with significant production increases from 963 to 1134 kg/ha.

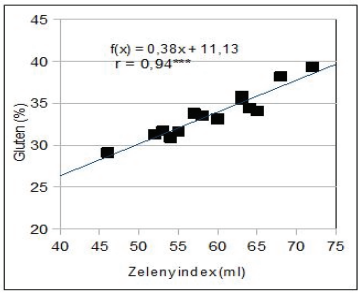

Figure 1. The correlation between the Zeleny index and gluten content of wheat grains

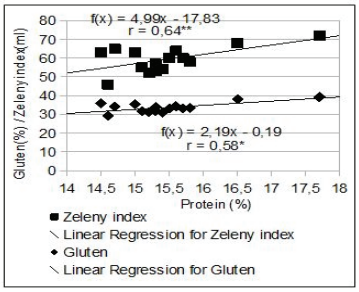

Figure 2. Correlation between protein content, Zelleny index and gluten content of wheat grains

Productivity elements that characterize the varieties studied are presented in Table 2. Wheat varieties tested showed MMB value of 41-49 g and MH values of 72-76 kg/hl. The meteorological conditions during the experiment manifested reflected in production levels and the nutritional quality of the grain, stress factors (drought and heat) with different degrees of manifestation in the three years of study. The experimental results obtained in 2010-2012 are presented in Table 3.

Table 3. Influence of years of study over production and nutritional quality of wheat grain

Year	Moisture (%)	Protein (%)	Index Zeleny (ml)	Gluten (%)	Hectoliter weight (kg/hl)	Weight of 1000 seeds (g)	Production (kg/ha)
2010	13	16.73	-	-	75	48	3628
2011	12.53	14.3	34	60	74	41	3034
2012	11.3	14.56	33.4	61	75	41	3179
The average	12.28	15.2	33.7	61	75	43	3280

In the conditions a rich hydric and thermal regime, in which the phenomenon of heat was almost absent, which characterized 2010 on sandy soils in southern Oltenia production levels was higher compared to the years 2011 and 2012. Also, grain protein content was higher percentage (12.93%). The precipitations was quantitatively significant in May and June, but there have been after a relatively dry sandy soil area of southern Oltenia and wheat productivity elements were already formed. The temperature higher and lower precipitations, hurry completion phase formation straw, although stem length may remain lower than optimal temperature and humidity conditions. Stage in the formation of straw is accompanied by complex physiological processes, because at this time there is differentiation of the reproductive organs.

In the years 2011 and 2012 production levels was influenced by water stress and temperature registered in May-June when droughts and heat had a negative influence on training elements productivity of wheat plants.

Decreased grain moisture percentage in the three years of study, and the highest values were determined in 2010, a year rich in precipitation during May-June and the lowest was determined in 2012, characterized as the most dry year. The protein content of wheat grains presented the highest values in 2010 (16.76%) and in years with thermo-hydric stress in wheat grains was determined a lower protein content.

The relationship between production and quantity of protein in grains in the three-year study is represented by a positive linear correlation with a correlation factor very significantly (Figure 3). The relationship between quality indices: index Zeleny, gluten and protein is more intense the climatic conditions specific to each year compared with the average for the three years of study. The correlation coefficients are highly significant (Figure 4).

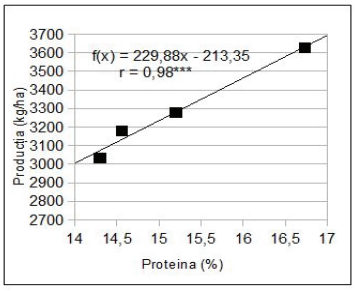

Figure 3. Correlation between production and quantity of protein in grains

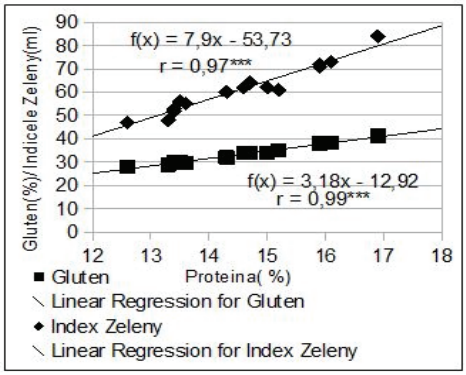

Figure 4. Correlation between protein the content, Zelleny index and gluten content of wheat grains (2012)

Evolution of maximum temperatures >30°C (25 days), relative humidity < 30% (20 days) in May and June 2012 and the amount higher average temperatures from 476°C annual average, allowed the determination of the relationship between production and the number of days from 1 May to gray phase. Thus, significant negative correlation coefficient (r =-0.66 **) suggest that precocity of wheat represents one of physiological mechanisms that determine mitigate drought (Figure 7). In terms of precipitation a year (2010) and a relatively dry year (2011), the correlation between production and the number of days until the gray is insignificant (Figures 5 and 6).

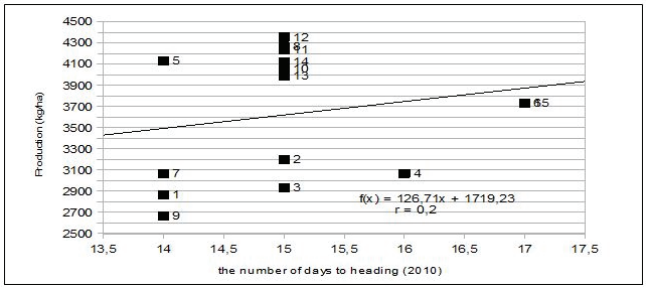

Figure 5. The correlation between production and the number of until the exit ear from 1 May 2010

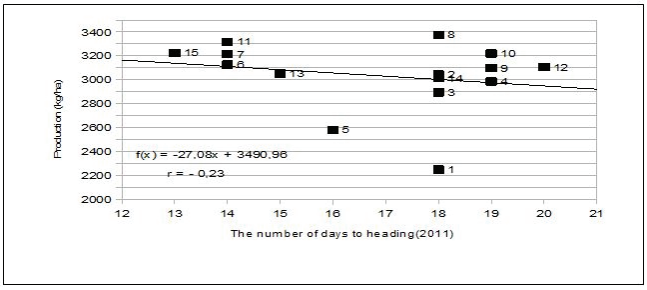

Figure 6. The correlation between production and the number of until the exit ear from 1 May 2011

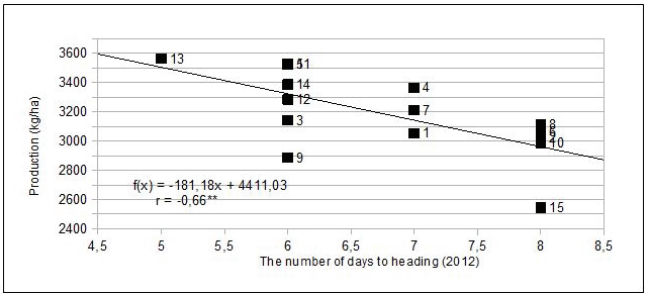

Figure 7. The correlation between production and the number of until the exit ear from 1 May 2012

CONCLUSIONS

Production and quality of production are strongly influenced by extreme climatic conditions (thermic and hydric stress) manifested during the experiment.

The level of production on three years have highlighted varieties, Delabrad (3586 kg/ha), Glossa, Ciprian, Boema (3692 kg/ha, 3675 kg/ha and 3308 kg/ha) results as very significant statistically ensured.

Protein content and wet gluten resulted in wheat grains gives a good quality production and best varieties were: Flacara, Delabrad, Capo, Lovrin

Between quality indicators studied were significant positive correlations determined. Thus the association of sedimentation index Zeleny and quantity of gluten with the content of protein is described by regression with a slope ascendant, that shows that these indices are directly proportional to the protein content of grains.

Negative and significant correlation between wheat production and the number of days until the exit ear from 1 May, under the conditions a dry year, shows that precocity variety can be a measure that can contribute to mitigate drought and heat.

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