COMPARATIVE EVALUATION OF SOME WHEAT VARIETIES FOR YIELD AND QUALITY ATTRIBUTES

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ABSTRACT

Identifying high-yielding wheat varieties for various agro-climatic conditions is important because the farmers are mostly relying on these varieties for wheat production. This comparative study aimed to evaluate the performance of six wheat varieties for yield and some quality attributes, in conventional cropping system from Agricultural Research and Development Station Șimnic, Craiova. The experiment was laid out according to a randomized complete block design (RCBD) with three replications. Statistical analysis of the data showed significant differences (p = 0.05) only for grain yield. The highest yield (4.03 t/ha) was recorded by the variety Litera followed by A 15 (3.90 t/ha) and Miranda (3.85 t/ha). The lowest yield was recorded by the variety Bezostaia (2.86 t/ha). It was observed that Bezostaia and Dacia varieties showed greater protein content (11.53% and 11.17%, respectively) than all other varieties, but these differences were statistically non-significant.

INTRODUCTION

Wheat (*Triticum aestivum* L) it a species that belongs to the Gramineae family being one of the most important cereal crops globally.

It is a staple food for billions of people in the world and it is used to make flour for breads, cookies, for fermentation to make beer and alcohol (Khan and Habib, 2003) or in the animal feed (Cola and Cola, 2014).

In 2018, the world's wheat production was 754 million tonnes and made it third highest production after maize (1,147 million tonnes) and rice paddy (782 million tonnes). Wheat is a major cereal grown in Romania being planted in approximately 2.44 million hectares; with an average yield of 7641 kg/ha (FAO, 2018).

In Oltenia region, drought is becoming a major environmental constraint on wheat production (Băbeanu et al., 2008; 2010).

In this regard, the identification and cultivation of high yielding and tolerant varieties (for high stability) with good quality has a special place in the wheat breeding programmes.

The correct understanding of cultivar adaptation to different environments conditions has a great relevance in agronomy and plant breeding (Iwańska et al., 2020).

A genotype (variety, hybrid) is considered to be more adaptive if it has a high mean yield with low degree of fluctuations in diverse climatic conditions (Bonea 2020, Constantinescu et al., 2009; Urechean et al., 2019)

The protein content of wheat grain depends on the cropping technology (irrigation, fertilization) and agro-climatic conditions.

High protein content is associated with a good baking quality (Constantinescu and Olaru, 2017)

The aim of the study was to evaluate the grain yield and some quality attributes of six wheat varieties under the agro-climatic conditions of ARDS Simnic

MATERIAL AND METHOD

This research was carried out in the 2018-2019 growing season in conventional cropping system on the preluvosol specific to the ARDS Simnic area, Craiova, Romania.

The experiment was located in the field according to the randomized blocks method, in three replications.

The pre-crop plant was pea (*Pisum sativum* L.).

All the agronomic practices were carried out similar for all plots to exploit full potential of the tested varieties.

The biological material in this study consisted of six wheat varieties (*A 15, Dacia, Iulia, Litera, Miranda and Bezostaia*).

Data were recorded on the following parameters: yield per hectare adjusted to 14% moisture; grain moisture (%) by spectrometric method using NIR

analyzer; hectolitre mass (kg/hl) – by specific apparatus; protein content (%) by spectrometric method using NIR analyzer INFRAMATIC 9200.

Data were statistically analysed using analysis of variance (ANOVA). Significant differences among varieties were determined with the Duncan's multiple comparisons tests at 5% level of probability.

In the 2018-2019 agricultural growing season, the total amount of rainfall was 428.9 mm (from October 2018 until July 2019). The average daily temperature was 9.46°C (Table 1).

In these conditions, due to the deficit of precipitation (-44.9 mm), the tested wheat varieties achieved lower yield performances.

Table 1

Climatic conditions during the 2018-2019 growing season, ARDS Simnic, Craiova

Month	Air temperature (°C)			Rainfaill (mm)		
	Monthly average	Multiannual average	Deviation	Monthly sum	Multiannual average	Deviation
October	14.3	11.8	2,5	0	44.5	-44.5
November	5.5	5.5	0	51	44.9	6.1
December	-0,3	0.4	-0.1	37	45.1	-8.1
January	-1	-1.4	0.4	39.5	32.7	6.8
February	4.1	1.0	3.1	8,4	30.6	-22.2
March	11.0	5.6	5.4	24.0	33.7	-9.7
April	11.9	11.8	0.1	42.0	46.0	-4.0
May	16.2	16.9	-0.7	32.0	66.9	-34.9
June	22.7	20.4	2.3	136.0	67.9	68.1
July	22.9	22.6	0.3	59.0	61.5	-2.5
Sum/ average	10.76	9.46	+1.33	428.9	473.8	-44.9

RESULTS AND DISCUSSIONS

The analysis of variance (ANOVA) revealed the existence of genotypic differences between varieties. The wheat variety has a significant action (p = 0.05) only on the grain yield (Table 2).

Table 2

Mean squares (MS) for traits of wheat evaluated at ARDS Simnic (ANOVA)

Source	DF (Degrees Freedom)	MS (Mean Squares)			
		Yield (t/ha)	Grain moisture (%)	Hectolitre mass (kg/hl)	Protein content (%)
Varieties	5	0.673	0.827	5.658	0.900
Error	12	0.150	0.698	3.410	0.296
F- test		*	ns	ns	ns

* : significant at p = 0.05; ns : non-significant

Analysing the grain yield of the varieties tested in this experiment was observed that, because of the unfavourable conditions of this year of study, the yield was lower and varied between 2.86 t/ha and 4.03 t/ha (Figure 1).

The highest grain yield was recorded from the Litera variety (4.03 t/ha) followed by A15 variety (3.90 t/ha) and Miranda variety (3.85 t/ha) and the lowest in Bezostaia variety (2.86 t/ha) and these differences were statistically significant.
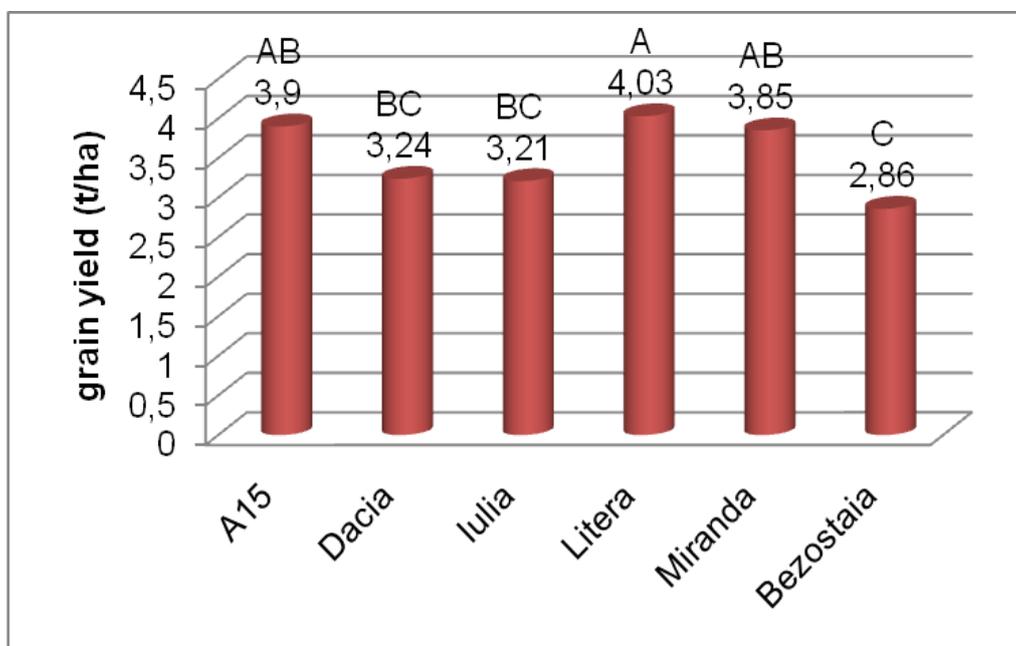
Means followed by different letters in each column are significantly different from each other at 5% level of significance

Figure 1. Grain yield of the wheat varieties

According to Paunescu et al., (2018) the average yield for several Romanian varieties cultivated at ARDS Simnic in conventional system was of 5.5 t/ha, value much at variance with our own results, whereas according to Voica and Lazar (2018), the yield was in average of 2.49 t/ha or 3.22 t/ha for several

Romanian varieties cultivated at ARDS Pitești (depending on the fertilization doses), values partly aligned with our results.

Many others authors have also reported significant differences for grain yield in different varieties, depending on the local climatic conditions, applied technology etc. (Dumbravă et al., 2019; Racz et al., 2015).

The moisture content of wheat grains for tested varieties was ranged from 14.93% in Bezostaia variety to 16.33% in Litera variety, but with non-significant differences (Figure 2).

It is noted that, in terms of grain moisture, all varieties tested exceeded the storage limit value of 14% (according to STAS ISO 7970/2001), therefore it is necessary to their drying.

The grain moisture is of vital importance for storage and for milling industry. High grain moisture determines a higher microbial activity.
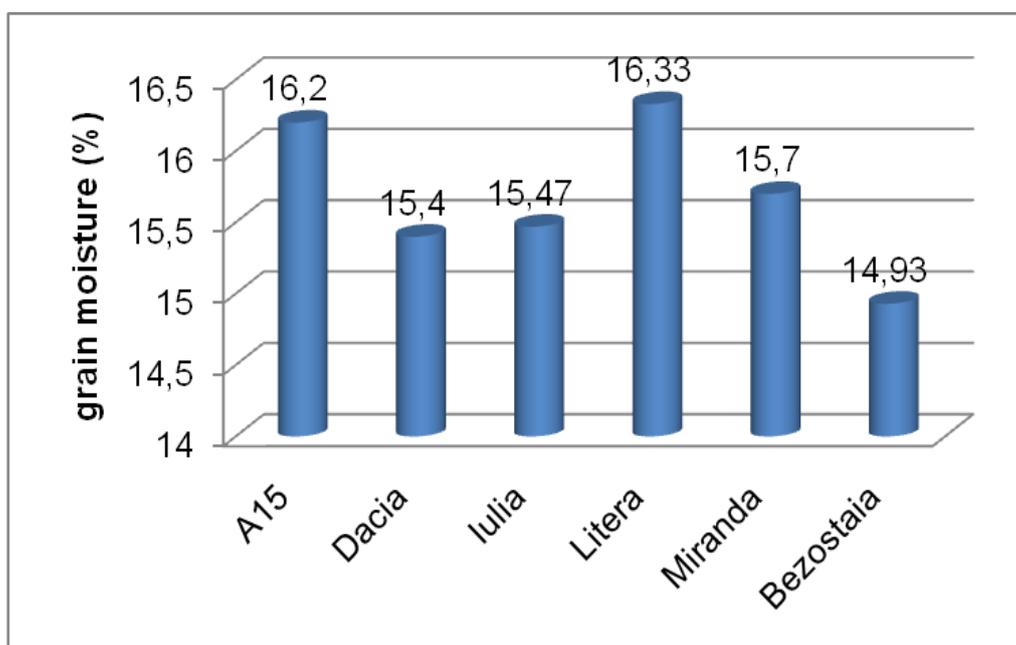
Figure 2. The grain moisture of the wheat varieties

The hectolitre mass has had values between 69.6 kg/hl (A15 variety) and 73.43 kg/hl (Litera variety) - Figure 3. These values were lower because of the unfavorable climatic conditions

The hectoliter mass is an indicator of interest to both farmers and the milling industry (Marinciu et al., 2019).

According to the Grading Manual from 2017 (CNGSC, 2017), Grade I includes wheat with a value of at least 77 kg/hl; Grade II of at least 75 kg/hl and Grade III of at least 72 kg/hl.

Therefore, A15 and Dacia varieties that registered values below 72 kg/hl had an unsatisfactory quality and the rest of the tested varieties falling within the Grade III of quality.

Similar values for hectolitre mass of several Romanian varieties tested at ARDS Simnic (68.3 - 77.4 kg/ha) were reported by Paunescu et al. (2018).

As regard the protein content, some mills and bakeries require a minimum of 12.8% or even higher protein concentration in wheat flour, but this protein concentration requires high fertilizer rates applied after anthesis. Because of increased N fertilizer and genotypic improvement, the protein concentration in grains, in German wheat modern genotypes rose to 12–16% (Zörb et al., 2018).

According to the Grading Manual from 2017 (CNGSC, 2017), Grade I includes wheat with a protein content of

at least 12%, and Grade II of at least 11%.

For export the demands are different depending on the country: for Russia, Ukraine the price of wheat differs from 12.5% protein content (Marinciu et al., 2019).

In our study, the protein content for varieties tested was between 10.17% (Miranda variety) and 11.53% (Bezostaia variety), but the differences were statistically non-significant (Figure 4).

Among the wheat varieties tested, only Dacia and Bezostaia exceeded the value of 11%, falling within the Grade II of quality.

The wheat grain protein content is influenced by many factors such as: genotype, temperature, rainfall, soil fertility etc., and the higher protein content has been associated with good bread making quality (Dumbrava et al., 2019; Marinciu and Saulescu, 2008).
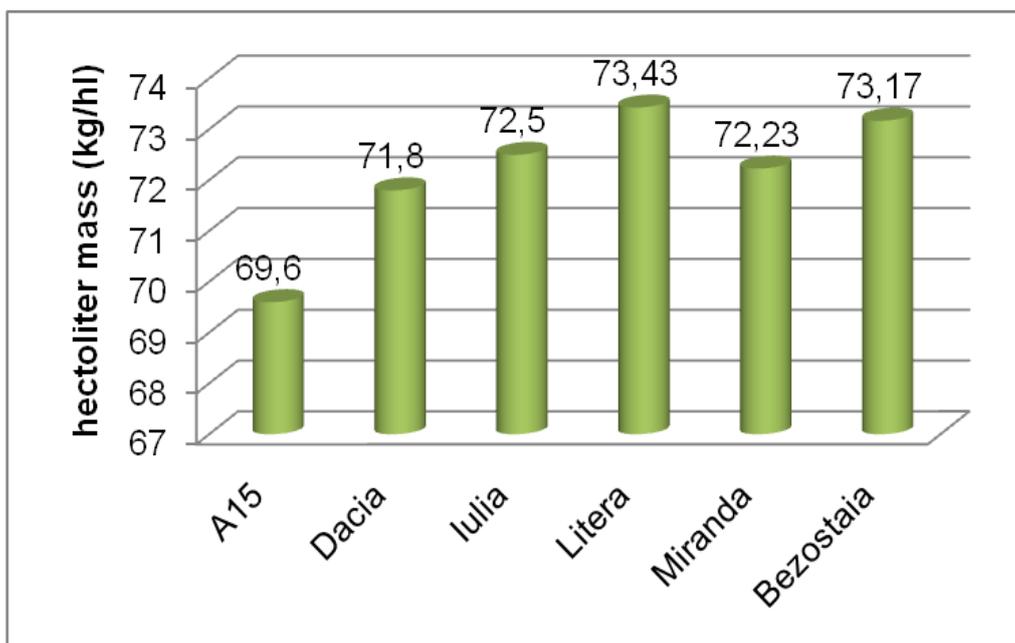
Figure 3. The hectoliter mass of the wheat varieties
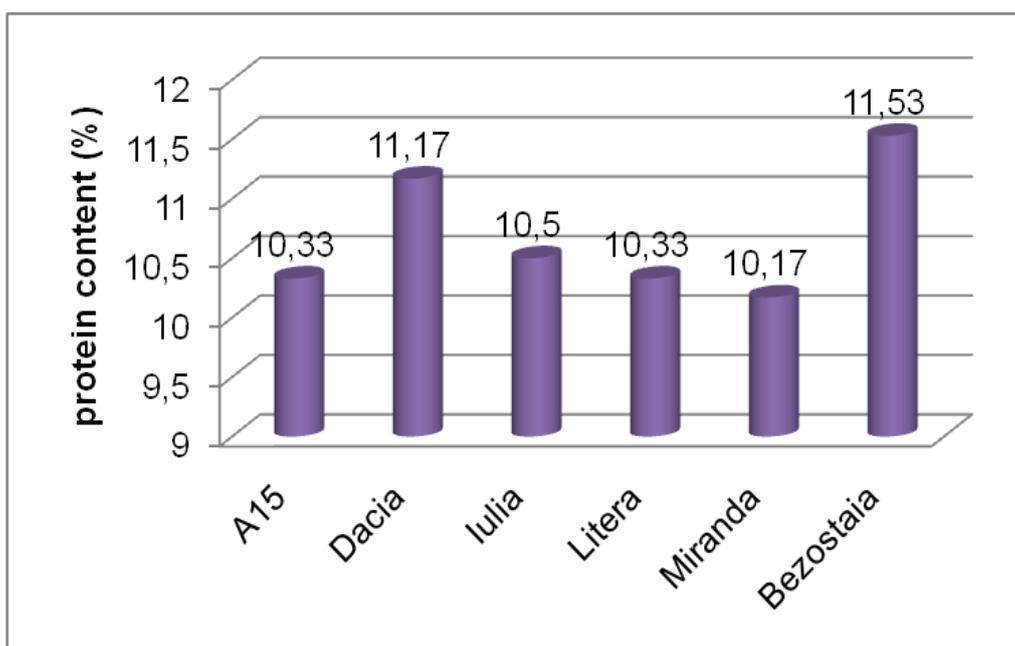
Figure 4. The protein content of the wheat varieties

CONCLUSIONS

Evaluation of the performances of wheat varieties is an important task in breeding program for central zone of Oltenia.

Based on single year of study, it can be concluded that wheat varieties Litera, A15 and Miranda showed high productivity in the group tested and are the best adapted to the climatic conditions for this area.

On the other hand, Bezostaia and Dacia varieties showed a lower yield but higher protein content than all other varieties tested.

It was noticed that, despite efforts by breeders, the negative correlation between yield and grains protein content is difficult to break. So, farmers have to decide which market to target: the animal feed market (varieties with high grain yield) or the bread-making market with high quality (varieties with high protein content).

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