

STUDY ON THE YIELD AND PRODUCTIVITY ELEMENTS OF AN ASSORTMENT OF WINTER WHEAT CULTIVATED AT ARDS CARACAL

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ABSTRACT

On the chernozem from Caracal, in the agricultural years 2018-2019 and 2019-2020, 9 wheat varieties of Romanian origin were tested, creations of NARDI Fundulea: Glosa, Miranda, Izvor, Otilia, Pitar, Pajura, Semnal, Ursita and Voinic. The following characteristics were determined: height, number of ears / sqm, thousand kernel weight, test weight and yield. On average, none of the wheat varieties tested was significantly superior to the control variety Glosa, in terms of yield, although in the second year of testing the varieties Miranda, Pajura, Ursita stood out with significant increases. The average yield was within the limits of 8520 kg / ha for the Izvor variety and 9429 kg / ha for the Ursita variety. The correlations between yield and height, on one hand, and yield and test weight, on the other hand, were not significant, although 29% and respectively, 19% of yield variability, were associated with the variability of correlated characters. Deviations from the sense of correlation were present for the varieties Ursita and Pajura which had both high yields and high test weight, the correlation being negative.

INTRODUCTION

Cereals are the main source of food for humanity, and of these, wheat ranks third in use after corn and rice, and in terms of nutrition it comes second to rice.

Climate change in recent decades, manifested mainly by the increase in the frequency of dry years and implicitly by the trend of an arid climate, is a limiting factor in increasing agricultural yield facing such an increasing global demand for food in the context of the expanding population.

The introduction into cultivation of new wheat varieties, which are more productive and adapted to abiotic and biotic stress, the choice of varieties resistant to thermal and water stress and the adaptation of crops' technology, are the essential conditions for increasing productivity under drought conditions. The choice of a variety unsuitable for drought conditions can, however, cause all other investments in wheat cultivation to be capitalized only partly (Mustățea et al., 2003).

The quality of cereal seeds is determined by the quality of genetic material, soil type, level of applied technologies, providing the technical-material base (machines, fertilizers, pesticides, irrigation) and the degree of qualification, information, research and innovation of multipliers (Băcanu et al. , 2017).

The choice of varieties resistant to thermal and water stress (drought, drought accompanied by heat) plays an important role in agriculture (Stanciu, 2016 b). However, the choice of the best variety cannot in itself guarantee good results under drought conditions, if the other technological links are not applied correctly. Wheat varieties that are unsuitable for drought conditions can only partially exploit their genetic potential under the correct application of other technological links. (Melucă et al., 2011).

Romanian wheat varieties are of great importance because they are adapted to drought conditions, thermal and water stress conditions (Băcanu et

al., 2018) that we have been facing over the recent years.

Compared to the most productive Western-European varieties, the new lines from Fundulea, currently in a rapid multiplication, had high yields, but also with a higher percentage of proteins clearly higher than them (Marinciu et al., 2019).

In order to obtain high and quality yields, the choice of wheat variety must be made taking into account the climate and soil conditions, as some varieties are well resistant to drought and frost, and

MATERIAL AND METHOD

Wheat cultivation alternates from one year to another in terms of areas, yield and cultivated varieties, being conditioned mainly by pedological and climatic factors.

Of the total area cultivated with wheat in Romania, the local winter wheat varieties have a share of about 70%, which represents around 1.5 million hectares in total.

In the agricultural practice, the choice of variety is an essential factor in wheat cultivation technology. Therefore, within ARDS Caracal, an assortment of winter wheat was cultivated for experimental purposes that would correspond to the cultivation requirements of the area, known for its tendency to an arid climate.

The soil on which the research was conducted is of the cambic chernozem type, with a weak acid reaction (pH = 5.84) and a low content of mobile aluminum; the humus content indicates a medium degree of assurance (H% = 3.04), as well as the nitrogen index (IN = 2.4%); the phosphate content accessible to plants indicates a good state of security, as well as the mobile potassium content from the soil.

The research carried out during two agricultural years (2018-2019, 2019-2020), focused on the elements of productivity and implicitly the yield of nine wheat genotypes, with high yield potential

others adapt even to soils with low fertility.

In Oltenia drought is becoming a major environmental constraint on crop production and one of the solicited characteristics in the present in these area is drought tolerance. (Băbeanu C. și colab., 2008; Matei Ghe., 2011).

This paper aims to analyze the yield and productivity elements of an assortment of winter wheat, under specific abiotic conditions manifested during the experimentation period.

and good drought tolerance. All cultivated varieties are Romanian, and are creations of NARDI Fundulea: Glosa, Miranda, Izvor, Otilia, Pitar, Pajura, Semnal, Ursita, Voinic.

The experiment was carried out in both years under the same conditions: non-irrigated, same soil works, fertilization (basis in doses of N₅₀P₅₀ - 20-20-0 and in vegetation N₉₀ – NH₄NO₃).

The wheat assortment was analyzed in terms of average yields, as well as productivity elements: number of ears / m² and thousand kernel weight (TKW), test weight (TW) as a quality index of yield and height - morphological character of wheat cultivation. All these characters were correlated with the yield and with each other to determine the coefficient of determination and the equation of the linear correlation that allows the interpretation of the results by its meaning (positive or negative) and significance.

RESULTS AND DISCUSSIONS

At the European level, in 2019, Romania ranked fourth, after France, Germany and Poland both in terms of cultivated area (2.1 million ha) and in terms of average yield (4.8 t / ha).

Romania's wheat yield in 2020 registered a decrease of approximately 40% (2.9 t / ha), compared to 2019, the cause being the drought that plagued a large part of winter crops.

The yield results obtained for the varieties within the experimental device from ARDS Caracal were way above the national average yield, both in 2019 and in 2020. These results are largely due to the genetic potential of the varieties, all of which are varieties of high productivity and resistant to thermal and water stress conditions.

In 2018-2019, all of the varieties tested were at a control level in terms of yield. With only one exception, the thousand kernel weight had values over 40 g. Instead, the test weight was low. Here the exception was the Izvor variety, but in a positive way, with a value above the minimum take-over limit - 76 kg / hl (table 1).

Table 1

Yield, productivity elements and other characteristics of a wheat assortment from ARDS Caracal (2018-2019)

Variety	Height (cm)	No. of ears/m ²	TKW (g)	TW (kg/ha)	Yield		
					Average yield (kg/ha)	Difference regarding ct.	Significance
Glosa	106	694	43,02	75	8351	ct	
Miranda	110,5	756	41,73	72,6	8692	341	
Izvor	106,5	693	40,61	76,9	7987	-354	
Otilia	107	672	38,81	73,9	8468	117	
Pitar	108	655	42,53	74,4	7952	-399	
Pajura	110	666	44,51	75,5	8425	74	
Semnal	112	694	46,42	74,9	8651	300	
Ursita	109,5	718	41,2	75,3	8844	493	
Voinic	106	644	41,93	75,4	8223	-128	
					DL 5% = 813 kg/ha; DL 1% = 1101 kg/ha; DL 0,1% = 1475 kg/ha		

Because the technology was the same in both years, the differences in reporting to the control variety were mostly due to different climatic conditions of this agricultural year than of the previous one. The varieties Miranda,

Pajura and Ursita showed significant yield increases in relation to the control variety ranging from 837-890 kg / ha. Although with a smaller thousand kernel weight, they settled much better in the volume unit, all of them weighing over 76 kg / hl and exceedingly even 80 kg / hl (Table 2).

Table 2

Yield, productivity elements and other characteristics of a wheat assortment from ARDS Caracal (2019-2020)

Variety	Height (cm)	No. of ears/m ²	TKW (g)	TW (kg/ha)	Yield		
					Average yield (kg/ha)	Difference regarding ct.	Significance
Glosa	89,5	710	44,3	79,3	9124	ct	
Miranda	95,5	640	42,9	76,5	10004	880	*

Izvor	95,5	900	40,6	80,8	9053	-71	
Otilia	90	910	35,6	79,4	9469	345	
Pitar	89,5	685	39,9	78,4	9662	538	
Pajura	90,5	810	43,4	80,7	9961	837	*
Semnal	91	860	39,5	78,8	9554	430	
Ursita	92,5	775	42,4	79,9	10014	890	*
Voinic	90	725	39,9	79,5	9506	382	
						DL 5% = 834 kg/ha; DL 1% = 1130 kg/ha; DL 0,1% = 1513 kg/ha	

This year's high yield was also due to the fact that the wheat field was presented with ears at same height, all on one level, full of smaller but much more grains.

On average over the two years, the yields of the tested varieties were high but at a control level (Table 3).

Table 3

Yield, productivity elements and other characteristics of a wheat assortment from ARDS Caracal (average 2018-2020)

Variety	Height (cm)	No. of ears/m ²	TKW (g)	TW (kg/ha)	Yield		
					Average Yield (kg/ha)	Difference regarding ct.	Significance
Glosa	97,75	702	43,66	77,15	8737,5	ct	
Miranda	103	698	42,31	74,55	9348	610.5	
Izvor	101	796,5	40,6	78,85	8520	-217.5	
Otilia	98,5	791	37,2	76,65	8968,5	231	
Pitar	98,75	670	41,21	76,4	8807	69.5	
Pajura	100,25	738	43,95	78,1	9193	455.5	
Semnal	101,5	777	42,96	76,85	9102,5	365	
Ursita	101	746,5	41,8	77,6	9429	691.5	
Voinic	98	684,5	40,91	77,45	8864,5	127	
					DL 5% = 824 kg/ha; DL 1% = 1116 kg/ha; DL 0,1% = 1494 kg/ha		

A productive potential of 8-9 t / ha is the dream of any farmer and it can be translated into rich harvests by applying conventional technologies with medium inputs under pedo-climatic conditions such as those from ARDS Caracal, using established or recently approved Romanian varieties.

Correlations between the studied characters existed but were not significant, on one hand due to the small number of variants (limited provenance) and on the other hand due to the absence of large differences between the tested variants (table 4).

Table 4

Correlations between yields and the studied characters for a wheat assortment from ARDS Caracal (average 2018-2020)

	Yield	Height	No. of ears/sqm	TKW	TW
Yield	1	0.544	-0.056	0.242	-0.437
Height	-	1	0.288	0.265	-0.274
No. of ears/sqm	-	-	1	-0.356	0.437
TKW	-	-	-	1	0.034
TW	-	-	-	-	1

Two of the correlations with yield had values over 0.400: yield - height and yield- test weight.

The positive correlation ($r = 0.544$) between yield and height is not significant (for the number of cases = 9, the significance occurs from 0.670 for P5%) but the coefficient of determination shows that 29% of yield variability is associated with height variability (figure 1).

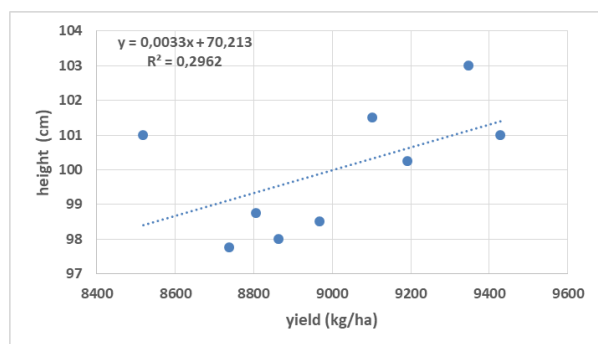


Figure 1. Correlation between yield and height of a wheat assortment tested at ARDS Caracal (average 2018-2020)

The linear equation shows that an increase in height by 1 cm brings an increase in yield by 300 kg / ha, for the studied interval.

The negative correlation ($r = -0.437$) between yield and test weight is not significant and between the two characters only 19% of the variability of yield is associated with the variability of the test weight (figure 2).

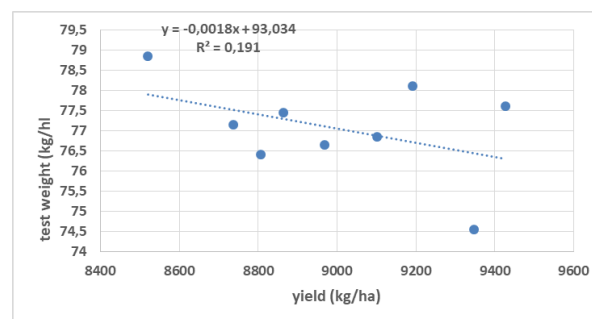


Figure 2. Correlation between yield and test weight for a wheat assortment tested at ARDS Caracal (average 2018-2020)

The linear equation shows that a decrease in hectoliter mass by 1 kg / hl leads to an increase in yield by about 600 kg / ha, for the studied interval.

Deviations from the sense of correlation were present at the varieties Ursita and Pajura which had both - high yields and high test weight.

CONCLUSIONS

The average yield was within the limits of 8520 kg / ha for the Izvor variety and 9429 kg / ha for the Ursita variety. The productive potential of 8-9 t / ha can be translated into rich harvests by applying conventional technologies with medium inputs under pedo-climatic conditions such as those from ARDS Caracal, using well-known or recent Romanian varieties;

On average, none of the tested wheat varieties was significantly superior

to the control variety Glosa, in terms of yield, although in the second year of testing, the varieties Miranda, Pajura, Ursita were highlighted with significant increases;

The existing correlations between yield and height, on one hand, and yield and test weight, on the other hand, were not significant, although 29% and 19% of yield variability were associated with the variability of correlated characters;

Deviations from the sense of correlation between yield and test weight were present at the varieties Ursita and Pajura which had high values for both characters.

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