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CHARACTERISTICS OF SOME NEW VARIETIES AND LINES OF WHEAT UNDER THE YEAR 2021-2022 CONDITIONS

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Abstract

And in the conditions of luvic soils, a series of new characters were obtained in winter wheat lines. Compared to the control varieties, Trivale and Ursita, the 4 new lines obtained showed a number of improved characteristics. Thus, lines A4-10 and A57-14 approached the size of the Trivale variety, and in culture all these lines showed a very good uniformity. In terms of the ear formed, the new lines have surpassed those of the Trivale variety in length. Spike weight was superior to A4-10 and A57-14. The number of grains in a spike was higher in the A57-14 line (42.0 grains). Under the same conditions, the weight of the grains in one ear in the lines A4-10 and A57-14 again exceeded the Trivale variety. Line A57-14 slightly outperformed the new Ursita wheat variety. Positive correlations were obtained between grain yield and crude protein (CP%) and between PB and wet gluten (WG%). From the results obtained with the new winter wheat lines, a genetic progress was found, which recommends the future steps for homologation.

Key words*: luvic soil, morphology, new wheat lines, production and quality.*

INTRODUCTION

Winter wheat is now widespread (Black & Halmer, 2006), due to high yields (Bonjean & William, 2001) and superior quality (Day et al., 2006). Varieties and especially new lines fall within these parameters due to ongoing breeding activity (Tester & Langridge, 2010). The areas where the plant grows and develops, the optimal parameters are the temperate ones. Because of this the plants develop in a moderately short season. Under these conditions, the grains form high-quality flour widely used in baking (Li et al., 2014). And the varieties that are part of the present study have a grain content in diverse and balanced nutritional elements, being very important in food human. Over time, the plant has evolved through the most important characters desired by the breeder, so from a genetic point of view, today wheat is considered one of the most genetically diverse cereals. For example, there are wheat types of autumn and spring, with dressed and naked grains. The studied varieties are part of the *erythrospermum* Korn variety. They have white spikes, awned with glabrous glumes and red grain. At the same time, these new varieties have in their composition also a reduced waist gene, thanks to which they become more productive, because they support fertilization at higher levels and mechanized harvesting. From a botanical point of view, the spike has a terminal position, is distich, 4-18 cm long. The spikelets that form them are sessile, they attach singly to the rachis in a zigzag pattern. The grain (caryopsis), is ellipsoidal in shape, with a central channel on one side, having a length of 4-12 mm and a thickness of 1.5-4 mm. The TGW is between 15-60 g. The height of the plants is between 50-150 cm. The research undertaken to establish the variation of some characters in the new wheat lines referred to: the length of the straw, the length and weight of the ear, the number and weight of grains in an ear.

MATERIALS AND METHODS

The experimental variants included two varieties: Trivale (Pitești) and Ursita (Fundulea), as well as 4 lines A4-10, A57-14, A44-13 and A95-13. The experiment was set up according to the balanced square method, where the variants were 8.4 sq m in four

repetitions. The technology used was within the parameters developed by the resort. At full maturity the two varieties and the new wheat lines were harvested and several determinations were made. In this way, the height, ear length, ear weight, number of grains in the ear, the weight of grains per ear and the average yield per ha were determined for the plants. From the point of view of grain quality, crude protein and wet gluten were determined using the PERTEN apparatus. In the statistical calculation, the Anova test was used to establish the 3 types of limit difference: LSD 5%, LSD 1% and LSD 0.1%. The test was applied both to the morphological characteristics of the wheat and to their quality. Simple correlations were established between the obtained values, in order to observe existing trends between the characters. The significance of the correlation coefficient was made by comparing it with the r_{max} value for the 5%, 1% and 0.1% levels of transgression probabilities.

RESULTS AND DISCUSSIONS

The influence of climatic factors on wheat plants. Regarding the monthly averages, two influences were found. Thus, in the period after sowing (October - December) (Table 1), the average of the period was 6.4°C with 0.6°C more than the multi-year average. In the second period (January - June), only in the month of June were found average values that exceeded the multi-year average. This proves that there was a technical nuance to the rise in temperatures due to global warming (Fang & Xiong, 2015). Regarding the precipitation regime, it was found for the first period in autumn, an increase of 1.6 mm, in the second analyzed period, deficiencies were found (January - March), after which the months (April - May), the rains were at the level of multiannual values. In the month of June, there was an accentuated deficit of rains. For wheat cultivated in the period 2021-2022, the water regime had a lack of 133.0 mm. This aspect obviously disadvantaged the wheat plants and especially the deposition of dry matter in the grains. From the point of view of the favorability of wheat for the Pitesti area, it is found that at the multiannual average of 338.3 mm, the water need of wheat is close to this (Etp = 378 mm).

Table 1. Climate factors evolution from winter wheat vegetation

Month	Temperatures, tn^{0}C		Precipitations, mm		Etp, mm
	Multi.	2022	Multi.	2022	
Oct.- Dec.	5.8	6.4	46.8	52.9	25
	±	**+0.6**	±	+6.1	
Jan	-1.1	1.4	39.7	6.6	28
Feb	0.7	3.7	38.0	10.4	28
Mar	4.8	3.6	36.5	31.0	40
Apr	11.0	10.8	53.6	66.4	72
May	16.3	17.1	79.5	76.6	96
Jun	19.5	21.6	91.0	14.3	114
Mean Sum	8.53	9.70	338.3	205.3	378
	±	**+1.17**	±	**-133.0**	

Evolution of morphological characters in wheat varieties and lines. Regarding the height of the plants, it was found that compared to the Trivale variety (check), both in Ursita and in the 4 lines, the average values exceeded them. Spike length was below 8 cm Trivale and A95-13, while in the other varieties, the values were very close (Table 2). Spike weight, specific experienced a significant increase in Ursita variety and lines A4-10 and A57-14. The number of grains in the ear was between 30.0 and 42.0, but without significant differences. The weight of these grains in one ear was between 1.05 and 1.49 g, also without significant differences. The same elements of statistical processing are found in the case of Table 3 of dispersion analysis for the wheat varieties studied.

Table 2. Morphological characters of winter wheat lines and varieties

Varieties, line	Plant high, cm	Ear length, cm	Ear weight, g	No. grains/ ear	Grains weight/ ear, g
Trivale	77	7.4	1.65	33.6	1.33
Ursita	114	**8.3**	**2.12**	39.1	1.47
A4-10	81	**8.4**	**1.88**	39.9	1.38
A57-14	83	**8.5**	**2.33**	42.0	1.49
A44-13	108	**8.4**	1.50	30.0	1.05
A95-13	**167**	7.3	1.55	34.4	1.24
LSD 5 % =	*68.6*	*0.24*	*0.223*	*2.45*	*0.233*
LSD 1 % =	*94.9*	*0.33*	*0.309*	*3.43*	*O.322*
LSD 0.1 % =	*131.2*	*0.46*	*0.427*	*4.74*	*0.445*

Table 3. Dispersion analysis of wheat plants morphology

Character		Plant high, cm			Ear length, cm			Ear weight, g			No. grains/ ear			Grain weight/ ear, g		
Variability c	LD	SP	S^2	F	SP	S^2	F	SP	S^2	F	SP	S^2	F	SP	S^2	F
Repetition	3	6160			0.75			0.08			6.23			0.04		
Variance	5	23291	4658	2.24	6.12	1.22	61***	2.20	0.44	22***	414.58	82.92	30.6***	0.54	0.11	5.5
Error	15	31122	2075	(2.90)	0.37	0.02		0.33	0.02		40.59	2.71		0.36	0.02	
Total	23	60573		(4.56)	7.24			2.61			461.41			0.94		

Correlations studied within morphological characters of wheat. Between the 5 morphological characters, determined in the two varieties and 4 new lines of wheat, both negative influences and positive characteristics were found. Regarding the height of the plants, with the other determinations (Figures 1-4), a positive aspect was highlighted, between the height of the plants and the length of the ear and 3 negative situations, respectively with the weight of the ear, the number of grains and the weight of the grains in an ear.

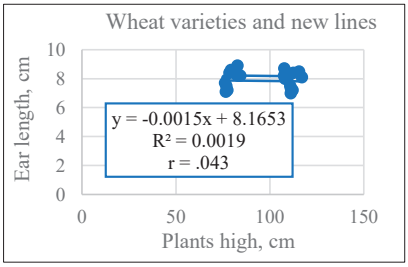

Figure 1. Correlation plants high x ear length

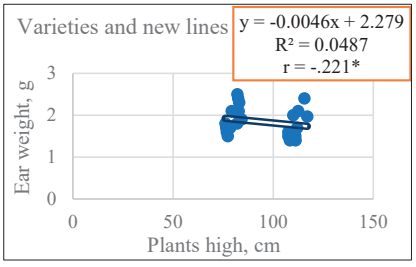

Figure 2. Correlation of plants high x ear weight

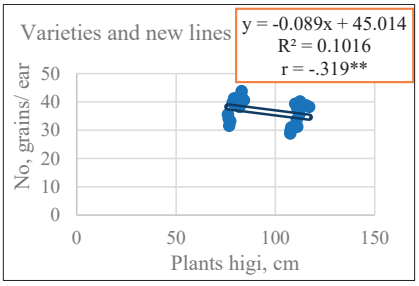

Figure 3. Correlation plants high x no. grains/ ear

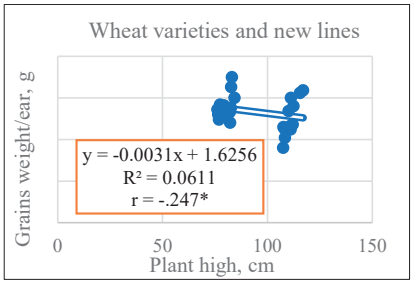

Figure 4. Correlation plants high x grains weight/ear

The explanation lies in the fact that at the time of the deposition of dry weight, there was an accentuated period of drought in the grains (Farooq et al., 2014). Spike length correlated with each other 3 characters out of one. From a significant point of view, ear length had favorable valences with ear weight and the number of grains in the ear. Only the grain weight in the ear was insignificant with the weight of the grain in the ear. The other correlations (Figures 5-10) being in a direct and highly significant relationship (Table 4).

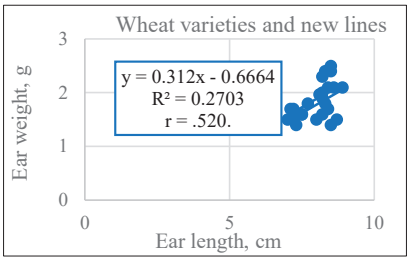

Figure 5. Correlation ear length x ear weight

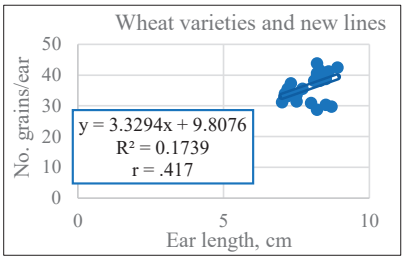

Figure 6. Correlation ear length x no. grains/ear

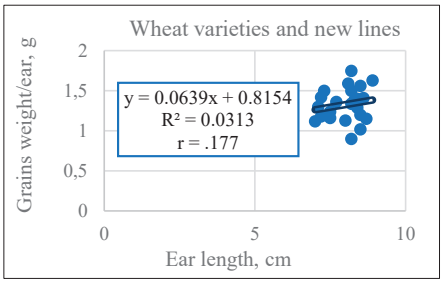

Figure 7. Correlation ear length x grains weight/ear

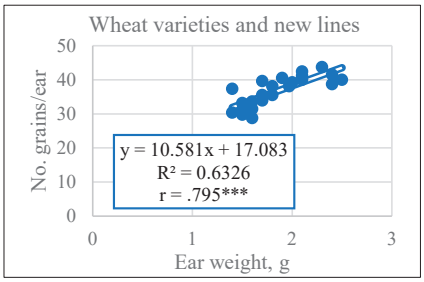

Figure 8. Correlation ear weight x no. grains/ear

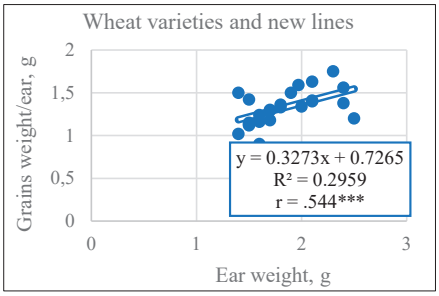

Figure 9. Correlation ear weight x grains weight/ear

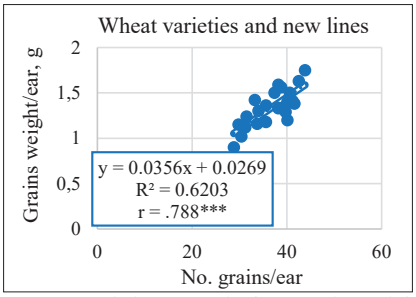

Figure 10. Correlation no. grains/ear x grains weight/ear

Table 4. Correlations between the main morphological elements

Characters	Ear length, cm	Ear weight, g	Number grains / ear	Grain weight/ ear, g
Plant high, cm	.043	**-.221**	**-.319**	**-.247**
Ear length, cm	1	**.520**	**.417**	.177
Ear weight, g		1	**.795**	**.544**
Number grains/ear			1	**.788**
	LSD 5 % = .190	*LSD 1 % = .250*	*LSD 0.1 % = .320*	

Evolution of wheat grain quality. Considering the obtained grain production of 5,451-7,570 t/ha, the lower lines than the control can be found in all 4 studied lines (Table 5). The protein content ranged between 10.05 (Ursita) and 13.90 (Trivale) and the crude protein of the lines was lower than mt. Moist gluten was 18.15% (A4-10) and (30.30%) A95-13. The obtained data are highlighted by dispersion analysis (Table 6).

Table 5. Aspects of grains quality

Variety, line	Grain yields, $t.ha^{-1}$	Crude protein, CP %	Wet gluten, WG%
Trivale	7,462	13.90	22.48
Ursita	7,570	10.05	21.90
A4-10	6,748	10.38	18.15
A57-14	5,451	10.90	24.60
A44-13	6,654	10.95	28.28
A95-13	6,388	**11.33**	**30.30**
LSD 5 % = *LSD 1 % =* *LSD 0.1 % =*	*0.459* *0.635* *0.878*	*0.683* *0.944* *1,305*	*5,255* *7,268* *10,044*

Table 6. Dispersion analysis wheat grains quality

Character	LD	Grain yields, t/ha			Crude protein, %			Wet gluten, %		
Variability c.		Sum sq.	S^2	F	Sum sq.	S^2	F	Sum sq.	S^2	F
Repetition	3	24.55			1.30			44.02		
Variance	5	11986.90	2397.4	25.8***	37.78	7.56	36.82***	619.04	123.81	10.18***
Error	15	1393.72	92.91	(2.90)	3.08	0.21		182.45	12.16	
Total	23	13405.2		(4.56)	42.16			845.51		

Correlations obtained between wheat quality analyses. Grain production was positively correlated with crude protein (Figure 11), demonstrating genetic gain in the quality of the wheat lines.

Regarding the correlation between grains and wet gluten, the trend was negative (Figure 12), which means that climatic factors were resilient to this character.

Between crude protein and wet gluten (Figure 13), a positive but insignificant relationship is found. This means that the new wheat lines also demonstrated high baking capacity (Figures 14, 15, 16), the intensity of the correlations in Table 7.

Table 7. Correlations between the first main quality elements

Character	Yields, t/ha	Crude protein, %	Wet gluten, %
Grain yield	1	**.208**	**-.343**
CP, %		1	.066
WG, %			1
LSD 5 % = .190	LSD 1% = .250	LSD 0.1 % = .320	

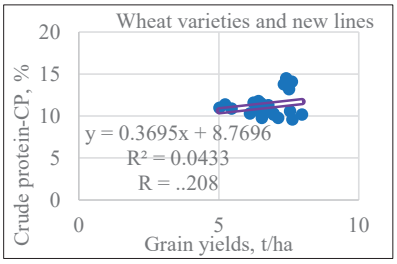

Figure 11. Correlation grain yields x CP %

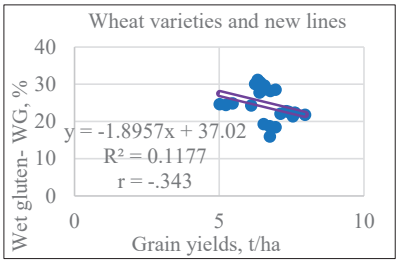

Figure 12. Correlation grain yields x WG %

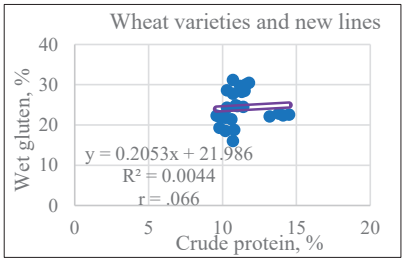

Figure 13. Correlation Crude protein x wet gluten

Figure 14. Ursita grains aspect

Figure 15. Ursita, the new wheat variety

Figure 16. A4-10, new wheat line

CONCLUSIONS

The new wheat lines studied, compared to two methods recommended at farm level, demonstrated both positive and negative characters. The climatic regime in which the wheat varieties grew this year experienced a warming of 1.17 °C throughout the vegetation period and a -133.0 mm of precipitation. Compared to the multiannual average but also to the ETP vegetation water requirement, obvious drought conditions were encountered. Due to drought, wheat could not manifest its characteristics in optimal perimeters (Farooq et

al., 2014). From the analysis of the morphology of the plants, the new wheat lines showed the average height, the long length of the ear, the weight of the ear, but with the number of grains and their weight in an ear, at insignificant values.

Plant height was negatively correlated with the other characteristics, highlighting the genetic character of plant growth reduction. Positive and highly significant correlations were established between the ear characters: length, weight, grain number and grain weight.

The relationship between crude protein and gluten was non-significant but positive, showing increased quality within the wheat lines.

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