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PHENOTYPIC VARIABILITY OF COMPONENTS OF PRODUCTION IN WHEAT (*Triticum aestivum* L.), UNDER THE CONDITIONS OF THE SOUTH OF THE COUNTRY

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Abstract

The aim of this paper is to conduct an ecological study of the variability of productivity elements in native wheat varieties. The research was carried out under field conditions at the Teleorman Agricultural Development Research Station in the agricultural years 2019-2020, 2020-2021, 2021-2022 and 2022-2023 on a pseudoglazed cambic chernoziom soil. 10 wheat varieties created at INCDA Fundulea were analyzed both from the phenological point of view and the variation of productivity elements under the influence of climatic factors. The productivity elements, although they were influenced by the climatic conditions of the years of study, had a small and medium variation, proving/confirming the fact that the native breeding material has a high adaptability to the variations of the climatic factors. The varieties Abund (7755 kg/ha), Ursita (7295 kg/ha) and Otilia (7117 kg/ha) stood out, drought-resistant varieties with productivity and quality corresponding to market requirements and high adaptability to biotic and abiotic factors, in conditions of climate change that can be cultivated successfully in the southern part of the country.

Key words*: wheat varieties, climate change, productivity elements, variability, production.*

INTRODUCTION

The ideal wheat variety for high productivity or any other desired trait must express genetic potential with a low value of variation in different crop environmental factors. Adaptation and productivity are, however, both complexly inherited traits and highly affected by the environment (Alard, 1997).
Understanding the causes of genotype-environment interaction can be used to set breeding goals, identify ideal test conditions, and formulate optimal cultivar recommendations for specific crop areas. (WeikaI and Hunt, 2001). The presence of genotype-environment interaction complicates the selection of superior genotypes, and understanding the environmental and genotypic causes of significant genotype-environment interaction is important at all stages of plant breeding (Dhungana et al., 2007).
Stability and adaptability represent the response of the genotype to environmental variation. Adaptability is a natural reaction of the genotype to survive and reproduce. Stability means a very small genotypic reaction to environmental changes, and in a broad sense, it could not be considered evolutionarily favorable under natural conditions. However, in agriculture, stability represents a desirable response of cultivated genotypes, forced and supported by humans, ensuring a similar level of production under different environmental conditions (Federer and Sculy, 1993; Lin and Binns, 1991; 1994).
Wheat production is a quantitative character with high variability, which is given by numerous production components, their formation under the influence of environmental conditions (Kraljevic-Balalic et al., 2001).
Global climate change, as well as regional climate change, influences agricultural behavior (Finlay and Wilkinson, 1963; Eberhart and Russel, 1966; Brady and Gabriel, 1978).
Production capacity is a complex quantitative character, determined by intrinsic factors (production components) and influencing factors (resistance to the unfavorable action of external factors). Each element of production is in turn a complex quantitative character, conditioned by hereditary factors and external factors.
Wheat production, according to Kamaluddin et al. (2007) depends on the number of

grains/surface unit and the weight of the grain, the latter being the resultant between the grain filling rate and the time period in which it was achieved (Gebeyehou et al., 1982; Van Sanford and Mackown, 1985; Bruckner and Frohberg, 1987).

The purpose of this work was to conduct an ecological study on the variability of productivity elements in the native wheat varieties developed at NARDI Fundulea.

MATERIALS AND METHODS

In the years 2019-2023 at the Teleorman Agricultural Development Research Station, a monofactorial experiment was established with 10 genotypes of common winter wheat. The research was carried out on a vertic subtype cambic chernoziom soil, having swelling clays as parent rock, a loamy-clay texture at the depth of the plowed layer (0-25 cm). From the point of view of physical and chemical properties, the soil is characterized by a clay content of 45%, humus 3.1%, slightly acidic soil reaction (pH = 6.1-6.5), total nitrogen content 0.166%, phosphorus mobile 40-60 ppm and mobile potassium 250 ppm.

The main hydro-physical indices of the soil on the 0-80 cm horizon have the following average values: apparent density 1.43 t/m^3, field capacity 27.3% (310.4 mm), wilting coefficient 15.0% (171.0 mm), minimum ceiling 21.1% (240.7 mm).

Applied technology: After harvesting the preceding plant, plant remains were destroyed, after which work was carried out with a disc, perpendicular passes. The preparation of the germinal bed was carried out with the combiner, 2 perpendicular works before sowing, when chemical fertilizers were incorporated into the soil (45 N s.a. kg/ha; 45 P s.a. kg/ha, 45 K s.a.kg/ha). After sowing, as the sowing conditions were very bad (drought), a ring roller work was carried out. In the winter windows, 54 N s.a. was applied. kg/ha, and in the spring in the last decade of March - the first decade of April (depending on the evolution of the climatic conditions in the study year) a phytosanitary treatment was applied with the following pesticide products: Mustang (florasulam 6.25 g/l + acid 2.4 D EHE 300 g/l) in a dose of 0.6 l/ha; Nuance (750 g/kg tribenuron methyl) in a dose of 14 g/ha; Inazuma (Acetamiprid 100 g/kg + Lambda-cyhalothrin 30 g/kg) in a dose of 0.3 kg/ha; Basfoliar Extra (N 27%; Mg 3%; + Mn, Fe, B, Zn, Mo, Cu) in a dose of 3l/ha; Trend (adjuvant) 0.150 l/ha in 180 l of water/ha. In order to test the genetic resistance of the variety to the attack of pathogens, no treatments with fungicidal products were carried out.

The years of experimentation were different from the point of view of the evolution of average monthly temperatures and precipitation during the vegetation period of autumn grass cereals.

The agricultural year 2022-2023, from the point of view of the average temperature recorded per agricultural year (13.6^0C), was the warmest year of the four years of study, compared to the multiannual average (10.70^{C}), the deviation was +2.8^0C, in 2019-2020 the deviation was positive 2.7^0C, in the agricultural year 2020-2021 positive deviation of 2.3^0C, and in the agricultural year 2021-2022 +1.9^0C. During the entire vegetation period, the deviations from the multi-annual average were positive, except for May, when the average deviation for the research years was -0.9^0C (Table 1).

Table 1. The evolution of average monthly temperatures during the years of experimentation at ARDS Teleorman

The year agricultural	Month												Average
	IX	X	XI	XII	I	II	III	IV	V	VI	VII	VIII	
2019-2020	20.2	14.0	10.4	3.3	0.5	4.9	8.0	11.9	16.6	21.1	24.7	25.4	13.4
Deviation	**+2.2**	**+2.4**	**+6.0**	**+3.6**	**+3.8**	**+5.4**	**+3.4**	**+0.0**	**-0.2**	**+0.5**	**+2.1**	**+3.0**	**+2.7**
2020-2021	21.3	14.5	5.1	3.4	0.8	3.1	4.7	9.5	17.3	24.6	26.3	25.5	13.0
Deviation	**+3.3**	**+2.9**	**+0.7**	**+3.7**	**+4.1**	**+3.6**	**+0.1**	**-2.4**	**+0.5**	**+4.0**	**+3.7**	**+3.1**	**+2.3**
2021-2022	18.5	10.4	7.3	2.1	1.4	4.4	4.0	11.4	18.0	23.0	25.7	25.9	12.7
Deviation	**+0.5**	**-1.2**	**+2.9**	**+2.4**	**+4.7**	**+4.9**	**-0.6**	**-0.5**	**+1.2**	**+2.4**	**+3.1**	**+3.5**	**+1.9**
2022-2023	18.9	14.1	8.8	2.9	4.3	3.6	7.9	11.1	16.2	21.9	26.6	26.5	13.6
Deviation	**+0.9**	**+2.5**	**+4.4**	**+3.2**	**+7.6**	**+4.1**	**+3.3**	**-0.8**	**-0.6**	**+1.3**	**+4.0**	**+4.1**	**+2.8**
Average 126 year	*18.0*	*1.6*	*4.4*	*-0.3*	*-3.3*	*-0.5*	*4.6*	*11.9*	*16.8*	*20.6*	*22.6*	*22.4*	10.7
Average deviation	**+1.7**	**+1.7**	**+3.5**	**+3.2**	**+5.1**	**+4.5**	**+1.6**	**-0.9**	**+0.2**	**+2.1**	**+3.2**	**+3.4**	**+2.4**

From the point of view of rainfall, the study years are characterized as follows: the 2020-2021 agricultural year the rainiest with the amount of precipitation of 697.5 mm with a deviation of +147.0 mm from the multi-year average, and the years 2019-2020, 2021-2022 and 2022-2023 dry years, the deviations from the multiannual average being -105.1 mm, -124.5 mm and -120.5 mm respectively (Table 2).

Table 2. Precipitation evolution during the years of experimentation at ARDS Teleorman

The year agricultural	Month												Total
	IX	X	XI	XII	I	II	III	IV	V	VI	VII	VIII	
2019-2020	2.5	28.4	51.8	16.0	5.8	68.5	74.0	20.0	79.0	84.0	2.8	12.6	**445.4**
Deviation	**-41.7**	**-10.1**	**+10.1**	**-25.4**	**-31.8**	**+37.8**	**+39.2**	**-22.1**	**+18.0**	**+12.0**	**-57.4**	**-33.7**	**-105.1**
2020-2021	65.0	64.0	8.0	79.0	118.0	10.5	98.0	36.0	83.0	99.0	1.0	36.0	**697.5**
Deviation	**+20.8**	**+25.5**	**-33.7**	**+37.6**	**+80.4**	**-20.2**	**+63.2**	**-6.1**	**+22.0**	**+27.0**	**-59.2**	**-10.3**	**+147.0**
2021-2022	4.5	111.4	31.5	59.0	7.0	19.0	19.0	73.0	22.0	36.5	22.1	21.0	**426.0**
Deviation	**-39,7**	**+72.9**	**-10.2**	**+17.6**	**-30.6**	**-11.7**	**-15.8**	**+30.9**	**-39.0**	**-35.5**	**-38.1**	**-25.3**	**-124.5**
2022-2023	26.0	9.0	61.0	39.5	87.0	12.5	24.0	55.0	54.0	31.0	16.0	15.0	**430.0**
Deviation	**-18.2**	**-29.5**	**+19.3**	**-1.9**	**+49.4**	**-18.2**	**-10.8**	**+12.9**	**-7.0**	**-41.0**	**-44.2**	**-31.3**	**-120.5**
Average 126 year	*44.2*	*38.5*	*41.7*	*41.4*	*37.6*	*30.7*	*34.8*	*42.1*	*61.0*	*72.0*	*60.2*	*46.3*	**550.5**
Average deviation	**-19.7**	**+14.7**	**-3.6**	**+7.0**	**+16.9**	**-3.1**	**+19.0**	**+3.9**	**-1.5**	**-9.4**	**-49.7**	**-25.2**	**-50.8**

Although the amounts of precipitation that fell during the wheat vegetation period as total amounts are not insignificant quantitatively, their distribution, according to the necessary vegetation phases, was unevenly distributed, which had repercussions on the quantity and quality of the productions obtained.

The data obtained as a result of biometric measurements, determinations and laboratory analyzes were statistically processed by determining the average values, the standard deviation of the average and the coefficient of variability, according to ARDELEAN (2008):

- arithmetic mean;
- the standard deviation of the mean;
- coefficient of variability (s%)
- analysis of variance (ANOVA)

The simple correlation coefficients (r) were calculated for the characteristics analyzed in each of the four experimental years, in order to establish the degree of association between the characteristics and the correlated ones.

RESULTS AND DISCUSSIONS

The preceding plant in the years 2019-2020 and 2021-2022 was the chickpea, and in the years 2020-2021 and 2022-2023 the pea (Table 3).

In the agricultural years 2019-2020 and 2020-2021 the experiments were sown on October 17 and emerged 23 days after sowing on November 9. In the year 2021-2022, sowing took place on October 27, and the emergence was recorded 14 days after sowing on November 10, and in the year 2022-2023 the experience was sown on 24.10.2022 and emerged after 57 of days on 20.12.2022 (Table 3).

Table 3. Sowing and emergence data from common winter wheat experiments

The year agricultural	Date of sowing	Date of emergence	Number of days sowing - emergence	The preceding plant
2019-2020	17.10.2019	9.11.2019	23	chickpeas
2020-2021	17.10.2020	9.11.2020	23	peas
2021-2022	27.10.2021	10.11.2021	14	chickpeas
2022-2023	24.10.2022	20.12.2022	57	peas

The density used for sowing was 550 b.g./m^2, and the number of plants sprouted in autumn, on average per experience, was 455 pl/m^2 in the year 2019-2020, 489 pl/m^2 in the year 2020-2021, 472 pl /m^2 in the year 2021-2022 and 485 pl/m^2 in the year 2022-2023 (tab. 4). The reduced density at sunrise in the year 2019-2020 (455 pl/m^2) is due to the very low water regime in that year.

All tested genotypes had weak twinning, thus the highest density, on average over the years of experimentation, was the Glosa variety (577 spikes/m^2), at the opposite pole was the Pitar variety (548 spikes/m^2) with the lowest number of ears per m^2.

Table 4. Density at sunrise of common winter wheat genotypes, ARDS Teleorman - 2019-2023

No.	Variant	No. emerged plants				Average genotype	Coefficient of variation (%)
		2019-2020	2020-2021	2021-2022	2022-2023		
1	Glosa	467	487	480	501	484	2.93
2	FDL Miranda	450	450	503	489	473	5.74
3	Otilia	467	497	485	489	485	2.62
4	Pitar	440	502	495	486	481	5.81
5	Izvor	465	494	491	477	482	2.78
6	Ursita	455	498	477	493	481	4.03
7	Voinic	448	500	413	459	455	7.88
8	FDL Abund	468	496	465	504	483	4.07
9	FDL Amurg	433	488	469	492	471	5.73
10	FDL Bogdana	455	478	445	455	458	3.05
Average year		455	489	472	485		

On average, on the varieties tested, the highest density of ears/m^2 was recorded in 2023 (598.5 ears/m^2), and the lowest density of ears/m^2 was recorded in the agricultural year 2019-2020 (500.4 ears/ m^2) (Table 5).

The variation of spike density/m^2 was small in 8 of the varieties studied (CV=5.11% Otilia) and medium in 2 varieties (CV= 12.77% FDL Miranda) (Table 5).

Table 5. Ear density per m^2 of common winter wheat genotypes, SCDA Teleorman - 2019-2023

No.	Variant	No. ears/m^2				Average genotype	Coefficient of variation (%)
		2019-2020	2020-2021	2021-2022	2022-2023		
1	Glosa	537	610	556	605	**577**	6.26
2	FDL Miranda	478	631	549	628	572	**12.77**
3	Otilia	521	578	554	584	559	**5.11**
4	Pitar	454	594	553	589	**548**	11.86
5	Izvor	521	574	563	610	567	6.46
6	Ursita	485	594	558	610	562	9.90
7	Voinic	479	579	557	601	554	9.59
8	FDL Abund	512	589	556	600	564	7.01
9	FDL Amurg	510	578	547	608	561	7.49
10	FDL Bogdana	507	588	555	550	550	6.05
Average year		500.4	591.5	554.8	598.5		

Analyzing the number of sprouted plants and the density of ears/m^2, it can be seen that in the formation of the crop, the contribution of the brothers is reduced. Due to the sowing in limiting climatic conditions (drought) which delayed the emergence, the twinning took place in the windows of winter (periods with positive temperatures) and in the late spring, a situation in which the formed brothers did not end up forming ears, only the main brother formed an ear which had little contribution to final wheat production. Considering that among the elements of productivity, the number of plants per surface unit and the number of ears per plant, respectively the number of ears per surface unit influence to the greatest extent the formation of the crop, for the southern part of the country the sowing density must be established so as to ensure a high density of ears without relying on the contribution of siblings.

On average over the years of experimentation, the number of grains in the ear had values between 39 grains/ear in the FDL Abund variety and the Otilia variety, and the lowest number of grains in the ear in the FDL Amurg (34.25 grains/ear).

The highest number of grains in the ear was obtained in the agricultural year 2021-2022, and the lowest number in the year 2020-2021 (Table 6). The coefficient of variation of the tested varieties was small and medium as follows: 5 varieties had small variation, the FDL Amurg variety standing out with CV=5.53%, and 5 medium variation varieties with the highest variation coefficient in the FDL Abund variety (CV+16.08%) (Table 6).

Table 6. The number of grains in the ear of wheat genotypes, ARDS Teleorman-2019-2023

No.	Variant	No. grain in ear				Average genotype	Coefficient of variation (%)
		2019-2020	2020-2021	2021-2022	2022-2023		
1	Glosa	34	33	40	36	35.75	8.66
2	FDL Miranda	35	34	41	34	36.00	9.35
3	Otilia	35	35	42	44	**39.00**	12.03
4	Pitar	37	33	37	37	36.00	5.56
5	Izvor	33	32	40	33	34.50	10.72
6	Ursita	34	34	40	31	34.75	10.86
7	Voinic	34	34	39	43	37.50	11.62
8	FDL Abund	34	34	41	47	**39.00**	**16.08**
9	FDL Amurg	34	33	37	33	34.25	**5.53**
10	FDL Bogdana	35	36	39	40	37.50	6.36
Average year		34.5	33.8	**39.6**	37.8		

The average weight of the grains in the ear was 1.38 g, on average over the years of experimentation, with the maximum value of 1.61 g in the FDL Abund variety and the minimum of 1.28 g in the Izvor variety. The highest weight of grains in the ear was obtained in the agricultural year 2019-2020, and the lowest weight in the agricultural year 2021-2022 (Table 7).

Table 7. Grain weight in the ear of wheat genotypes, ARDS Teleorman-2019-2023

No.	Variant	Grain weight per ear (g)					Coefficient of variation (%)
		2019-2020	2020-2021	2021-2022	2022-2023	Average genotype	
1	Glosa	1.55	1.38	1.27	1.33	1.38	8.71
2	FDL Miranda	1.55	1.38	1.25	1.20	1.35	11.62
3	Otilia	1.39	1.44	1.26	1.43	1.38	**6.00**
4	Pitar	1.67	1.32	1.15	1.38	1.38	15.69
5	Izvor	1.39	1.19	1.33	1.22	**1.28**	7.30
6	Ursita	1.48	1.40	1.26	1.23	1.34	8.78
7	Voinic	1.42	1.41	1.21	1.45	1.37	7.99
8	FDL Abund	1.47	1.48	1.22	1.88	**1.51**	**18.05**
9	FDL Amurg	1.54	1.38	1.12	1.44	1.37	13.08
10	FDL Bogdana	1.38	1.49	1.16	1.34	1.43	10.22
Average year		**1.48**	1.39	1.22	1.39		

The variation of the varieties studied in terms of the weight of the grains in the ear was small in 4 of the varieties with the minimum value of the coefficient of variation of 6.0% in the variety Otilia and 6 varieties varieties with medium variation with the maximum value of the coefficient of variation of 18, 5% in the FDL Amurg variety (Table 7). On average over the years, the weight of 1000 grains had values between 39.59 g for the FDL Amurg variety and 35.11 g for the Otilia variety. The weight of 1000 grains was strongly influenced by the climatic conditions in the years of study but also by the attack of pathogens, very obvious differences between the agricultural years 2019-2020, when the value of the weight of 1000 grains was 43.26 g and the agricultural year 2021 -2022 when the TWG of the varieties studied was 30.99 g (Table 8). Although this character was strongly influenced by climatic conditions, but also by the attack of pathogens, the variation of the varieties studied was medium, the highest coefficient of variation obtained by the variety FDL Miranda (17.5%) (Table 8). As in the case of the TWG, the hectoliter mass was strongly influenced by the climatic conditions (relative air humidity and temperature) as well as by the attack of pathogens in the study year. On average over the years of experimentation, the Ursita variety had the highest hectoliter weight of 78.26 kg/hl. On average, during the 2019-2020 agricultural year, the tested varieties had the highest hectoliter mass at 79.65 kg/hl, while the lowest hectoliter mass value of 72.66 kg/hl was recorded in the year 2021-2022 (Table 9). Strongly influenced by the climatic conditions but also by the attack of pathogens in the study year, the hectoliter mass had a small variation (CV<10%) in the case of all the varieties studied, with the exception of the Bogdana variety which had a medium variation of the MH (10 .99%) (Table 9).

Table 8. Weight of 1000 grains for wheat genotypes, ARDS Teleorman-2019-2023

No.	Variant	TWG (g)					Coefficient of variation (%)
		2019-2020	2020-2021	2021-2022	2022-2023	Average genotype	
1	Glosa	45.72	41.80	32.01	36.44	38.99	15.42
2	FDL Miranda	45.03	39.40	30.84	32.79	37.02	**17.50**
3	Otilia	40.27	38.90	30.06	31.22	**35.11**	14.86
4	Pitar	45.38	39.90	30.82	35.67	37.94	16.32
5	Izvor	42.08	38.30	33.42	31.65	36.36	**13.03**
6	Ursita	43.44	39.90	31.46	35.25	37.51	13.99
7	Voinic	41.99	40.30	31.19	35.01	37.12	13.33
8	FDL Abund	43.32	42.31	30.11	38.82	38.64	15.54
9	FDL Amurg	45.63	41.83	30.25	40.64	**39.59**	16.62
10	FDL Bogdana	39.71	40.18	29.69	36.52	36.53	13.25
Average year		**43.26**	40.28	**30.99**	35.40		

Table 9. Hectoliter mass obtained from common autumn wheat, ARDS Teleorman-2019-2023

No.	Variant	Hectoliter mass (kg/hl)					Coefficient of variation (%)
		2019-2020	2020-2021	2021-2022	2022-2023	Average genotype	
1	Glosa	80.20	80.35	75.75	74.1	77.60	4.07
2	FDL Miranda	78.20	79.00	70.55	69.6	74.34	6.66
3	Otilia	81.10	80.70	72.60	73.3	76.93	5.98
4	Pitar	80.00	79.45	73.25	73.3	76.50	4.88
5	Izvor	78.55	81.30	79.20	72.2	77.81	5.04
6	Ursita	80.30	80.90	76.85	75.0	**78.26**	3.59
7	Voinic	79.80	81.30	75.35	75.1	77.89	4.03
8	FDL Abund	79.00	80.00	70.85	74.6	76.11	5.54
9	FDL Amurg	79.30	76.80	70.60	72.6	74.83	5.27
10	FDL Bogdana	80.00	76.55	61.60	**74.73**	73.22	**10.99**
Average year		**79.65**	79.64	**72.66**	73.45		

The average production obtained by the wheat varieties studied was 6926 kg/ha, on average over the years of experimentation, the FDL Abund variety being noted, which achieved a production of 7755 kg/ha, and the least productive was the FDL Amurg variety which achieved a production of 6275 kg/ha. The highest production level was recorded in the 2022-2023 agricultural year (7301 kg/ha), and the lowest in the 2021-2022 agricultural year (6249 kg/ha). The variation in the production of the varieties studied during the 4 years of experimentation was small (CV>10%) in the varieties Izvor, Voinic, Otilia, Glosa, FDL Miranda and medium (CV>20%) in the varieties FDL Amurg, Pitar, Ursita, FDL Abund and FDL Bogdana (Table 10).

Table 10. Production results obtained in common autumn wheat varieties, ARDS Teleorman-2019-2023

No.	Variant	Average production la U=14% (kg/ha)					Coefficient of variation (%)
		2019-2020	2020-2021	2021-2022	2022-2023	Average genotype	
1	Glosa	7726	7279	6413	6737	7039	8.25
2	FDL Miranda	6619	7690	6189	6906	6851	9.23
3	**Otilia**	**7561**	**7183**	**6344**	**7378**	**7117**	7.55
4	Pitar	6249	7075	5772	7329	6606	10.94
5	Izvor	6135	6221	6877	6951	6546	6.53
6	**Ursita**	**7020**	**7444**	**6356**	**8358**	**7295**	11.50
7	Voinic	7064	7131	6154	6938	6822	6.63
8	**FDL Abund**	**7448**	**7566**	**6980**	**9027**	**7755**	11.41
9	FDL Amurg	5864	6904	5561	6769	6275	10.57
10	FDL Bogdana	7482	7858	5845	6620	6951	12.97
Average year		6917	7235	**6249**	**7301**	6926	

In order to highlight the importance of the experimental factors (genotype and year of experimentation) in the formation of the crop, the statistical analysis of the 10 genotypes of common autumn wheat was carried out.

The calculation and interpretation of production results was based on the analysis of variance of bifactorial experiments arranged in randomized blocks (Săulescu and Săulescu, 1967).

The experimental factors were: Factor A – genotype with 10 gradations (a1=Glosa; a2=FDL Miranda; a3=Otilia; a4=Pitar; a5= Izvor; a6= Ursita; a7= Voinic; a8= FDL Abund; a9= FDL Amurg; a10=FDL Bogdana); Factor B – the year of experimentation with 4 graduations (b1=2019-2020; b2 =2020-2021; b3=2021-2022, b4=2022-2023).

Analyzing the variance table of the bifactorial experience (10 genotypes × 4 years) we observe the very significant influence of the genotype and the year of experimentation (climatic conditions), also the interaction genotype x year of experimentation is very significant for the production of common autumn wheat obtained (Table 11).

Table 11. Analysis of variance (ANOVA) for production at bifactorial experience genotype x year of experimentation

The cause of variability	SP	GL	s²	Test F
The total	62033489	119		
Repetitions	277283.0065	2		
Years	26222839.36	3	8740946.5	260.11***
Genotype	9071453.3	9	1007939.3	29.99***
Interaction year X genotype	23840773.6	27	882991.6	26.28***
Error	2621140	78	33604.4	

The variety influences the production of autumn wheat obtained, on average over the years of experimentation, very significant increases in production of 830 kg/ha were obtained with the FDL Abund variety and the Ursita variety (369 kg/ha), and the Otilia variety obtained a distinct increase in production significantly (191 kg/ha), compared to the experience average (Table 12).

Compared to the favorable agricultural year for the wheat crop, the 2022-2023 agricultural year is noteworthy when very significant production increases of 376 kg/ha were obtained, compared to the average of experience, and the 2020-2021 agricultural year when very significant production increases were obtained significant amounts of 310 kg/ha (Table 13).

Table 12. The influence of the genotype on the production of common autumn wheat, ARDS Teleorman-2019-2023

No.	Variant	Yields		Difference ± CO	Signifi-cance
		kg/ha	%		
1	Glosa	7039	101.63	+113	
2	FDL Miranda	6851	98.92	-75	
3	**Otilia**	**7117**	**102.76**	**+191**	**
4	Pitar	6606	95.39	-319	
5	Izvor	6546	94.52	-380	
6	**Ursita**	**7295**	**105.33**	**+369**	***
7	Voinic	6822	98.50	-104	
8	**FDL Abund**	**7755**	**111.98**	**+830**	***
9	FDL Amurg	6275	90.60	-651	
10	FDL Bogdana	6951	100.37	+26	
Average		6926	100	MT	

LSD 5% = 148.93 kg/ha; LSD 1% = 197.57 kg/ha; LSD 0,1% = 255.20 kg/ha

Table 13. The influence of the year of experimentation on the production of common autumn wheat, ARDS Teleorman-2019-2023

The year of experimentation	Yields		Difference ± CO	Significance
	kg/ha	%		
2019-2020	6917	99.88	-9	
2020-2021	**7235**	**104.47**	**+310**	***
2021-2022	6249	90.23	-677	
2022-2023	**7301**	**105.42**	**+376**	***
Media	6926	100	MT	

LSD 5% = 94.19 kg/ha; LSD 1% = 124.96 kg/ha; LSD 0,1% = 161.40 kg/ha.

The production correlates positively with all the morph-productive elements (no. of emerged plants, no. of ears/m^2, no. of grains in the ear, the weight of the grains/ear and the MH), with the exception of the TWG where the correlation is negative (-0 ,0701). The number of emerged plants correlates negatively with the number of ears/m^2 (-0.0830) and positively with the weight of grains/ear (0.2029), with the TWG (0.0777) and with the MH (0.4134). Grain weight/ear correlates positively with number of emerged plants (0.2029), very weakly positively with number of ears/m^2 (-0.00005) and positively with number of grains per ear (0.6304). The TWG correlates positively with the number of emerged plants (0.0777) and the weight of grains per ear (0.4231) and negatively with the number of ears/m^2 (-0.0497) and the number of grains per ear (- 0.0497). The MH correlates positively with the number of emerged plants (0.4134), with the number of ears/m^2 (0.3274) and negatively with the number of grains in the ear (-0.1334), with the weight of grains in the ear (- 0.0573) and with the TWG (-0.0524) (Table 14).

Table 14. Correlation of yield with different morpho-productive elements in common winter wheat cultivars

	Yields (kg/ha)	No. emerged plants	No. ears/m^2	No. grain in ear	Grain weight/ear (g)	TWG (g)	MH (kg/hl)
Yields (kg/ha)	1						
No. emerged plants	0.2988	1					
No. ears/m^2	0.4175	0.4803	1				
No. grain in ear	0.6339	-0.0830	-0.0181	1			
Grain weight/ear (g)	0.6528	0.2029	0.00005	0.6304	1		
TWG (g)	-0.0701	0.0777	-0.0497	-0.0497	0.4231	1	
MH (kg/hl)	0.1657	0.4134	0.3274	-0.1334	-0.0573	-0.0524	1

In Romania, climate changes have determined in recent years, the intensification of water deficits (often associated with heat) during the vegetation of agricultural crops, in almost all areas of the country. Cultivating winter wheat varieties that can withstand drought and heat well is a decisive factor in obtaining stable and economically efficient productions.

The productivity elements, although they were influenced by the climatic conditions of the years of study, had a small and medium variation, proving/confirming the fact that the native breeding material has a high adaptability to the variations of the climatic factors.

Despite all the unfavorable abiotic factors, the genotypes tested at ARDS Teleorman managed to obtain productions, on average over the years of experience, of 6926 kg/ha.

The Abund, Ursita, Otilia and Glosa varieties stood out, drought-resistant varieties with productivity and quality corresponding to market requirements and high adaptability to biotic and abiotic factors, under the conditions of climate change, which can be successfully cultivated in the southern part of the country.

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