

RESEARCH ON THE ADAPTABILITY OF SOME WINTER WHEAT GENOTYPES IN A FERTILIZATION SYSTEM IN THE CONDITIONS OF A.R.D.S. SECUIENI

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Abstract

Common wheat occupies the largest area of cultivated land in the world due to its many attributes and easy, fully mechanized cultivation technology. During 2019/2022 at A.R.D.S. Secuieni, the behavior of some genotypes in the pedoclimatic conditions of Central Moldova was experimented. The yields and quality of the genotypes varied from one year to another, being influenced by the climatic conditions; the most favorable agricultural year for the winter wheat crop was 2020/2021, in which the yields of the genotypes were between 10189 kg/ha (Semnal) and 5798 kg/ha (T 42-17). The yields of the studied genotypes varied between 4527 kg/ha (Ursita variety in the agricultural year 2019/2020) and 10189 kg/ha (Semnal variety, in the agricultural year 2020/2021). From a qualitative point of view, the highest protein content was 17,0%, a percentage recorded by the Bezostaiia variety in the 2020/2021 agricultural year.

Key words: *Triticum aestivum* L., genotypes, adaptability, yields

Wheat is one of the most cultivated cereals, providing, along with rice and corn, the major part of the food for humans and animals.

In 2021, world production was estimated at over 785 million tons, up from 2020 (<https://agrobiznes.ro/articole/prognoza-fao2021>).

Being originally from South-West Asia, from the so-called Horn of Plenty, the species was domesticated and improved so that its yields and quality can be used for human consumption, and its technology fully mechanized leads the increase of cultivated areas (<https://ro.wikipedia.org/wiki/Gr%C3u>).

Wheat occupies the first place among the grains used in baking due to its yield but also to its clearly superior quality to other grains, and the bran obtained from the processing of wheat grains constitutes a good fodder for animals (Bîlteanu Gh. *et al*, 1979).

Wheat grains are rich in protein and gluten, and the amelioration process aims to increase the content in those indices.

In the specialized literature, the characters that determine the quality of wheat are described, the most important being genetics and the environmental conditions in which the species is cultivated. It has been demonstrated that in drier areas, where temperatures rise with 10 days before

inflorescence emergence, wheat accumulates more protein substances and in areas where the vegetation period is longer, with a colder and rainier climate, the non-nitrogenous extractive substances are especially accumulate (Mogârzan A., 2012, Roman V. *et al*, 2009).

The adaptability of wheat genotypes has been realized since ancient times, when humans took the einkorn wheat into culture, this representing the relationships and connections that exist between the genotype and the crop environment. During the vegetation period, plants are subject to some hereditary environmental factors, which together determine the genetic potential of the genotype: its level is the higher the more the environmental conditions correspond to its agrobiological requirements (Zhuchenko A.A., 2000).

MATERIAL AND METHOD

The research was carried out during 2019/2022 at A.R.D.S. Secuieni and aimed to establish the adaptability of 17 romanian winter wheat genotypes to the pedoclimatic conditions in the area.

Sowing was carried out in the optimal season, the preceding plant being represented by

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soybeans (2019/2020), rapeseed (2020/2021) and peas (2021/2022). The crop technology applied was the one specific to the area, and at sowing 550 g.g./sqm were ensured, the results obtained were processed and statistically interpreted according to the variance analysis method (Cepoiu N., 1968).

The quality analyzes were carried out with the NIR analyzer, brand Perten – NIR DA 7250.

The climatic conditions in the unit's area of influence show continuous climate warming. During those three years of research, it was observed that through the wheat growing season, the annual average of temperatures increased by

1.6°C compared to the multiannual average. The agricultural year 2019/2020 was the warmest, in which 9.4°C was the average temperature of the interval October 1, 2019 - July 31, 2020, with 2.1°C deviation from normal and the warmest month was February with 3.9°C average deviation over the three years compared to the normal (*table 1*).

It is also observed that the low winter temperatures below zero degrees are starting to disappear, so of the three agricultural years studied, only January recorded an average temperature of -0.5°C, but this too is increasing with 3.3°C deviation from normal (*table 1*).

Table 1

Average temperatures recorded at the weather station at A.R.D.S. Secuieni (2019/2022)

Month	Agricultural year			Normal	Average 2019/2022	Deviation
	2019/2020	2020/2021	2021/2022			
X	10.8	12.7	8.0	9.2	10.5	1.3
XI	7.8	3.9	5.6	3.6	5.8	2.2
XII	1.8	1.7	-0.2	-1.6	1.1	2.7
I	-0.6	-0.7	-0.1	-3.8	-0.5	3.3
II	3.4	-0.4	2.6	-2.0	1.9	3.9
III	6.2	2.9	2.7	2.8	3.9	1.1
IV	10.0	7.5	9.5	9.6	9.0	-0.6
V	13.9	14.7	16.3	15.4	15.0	-0.4
VI	20.0	19.2	20.7	18.9	20.0	1.1
VII	20.9	22.2	22.2	20.4	21.8	1.4
Annual average	9.4	8.4	8.7	7.3	8.8	1.6

From a pluviometric point of view, a decrease in precipitation during the wheat vegetation period is observed, recording 167.8 mm deviation over the three years studied (*table 2*).

The agricultural year 2021/2022 was the driest where the amount of precipitation had a value of 214.6 mm and the driest month recorded 36.6 mm deviation (July) (*table 2*).

Tabel 2

The precipitation recorded at the weather station at A.R.D.S. Secuieni (2019/2022)

Month	Agricultural year			Normal	Average 2019/2022	Deviation
	2019/2020	2020/2021	2021/2022			
X	33.0	27.2	3.0	37.7	21.1	-16.6
XI	14.6	7.4	10.8	28.3	10.9	-17.4
XII	6.2	38.2	39.0	25.0	27.8	2.8
I	2.0	12.2	5.4	20.0	6.5	-13.5
II	16.0	10.8	4.6	19.6	10.5	-9.1
III	10.2	31.8	0.8	26.6	14.3	-12.3
IV	1.2	23.8	38.4	45.4	21.1	-24.3
V	69.6	31.4	20.8	65.6	40.6	-25.0
VI	72.6	79.4	56.6	85.3	69.5	-15.8
VII	39.0	51.6	35.2	81.9	45.3	-36.6
Annual average	264.4	313.8	214.6	435.4	267.6	-167.8

RESULTS AND DISCUSSIONS

The yields of the wheat genotypes varied in the three agricultural years studied according to the climatic conditions.

In the 2019/2020 agricultural year the yields were between 4527 kg/ha which was obtained with the variant sown with Ursita variety and 8081 kg/ha which was obtained with Bogdana variety (*table 3*).

Compared to the control of the experience (Glosa) the genotypes Otilia, Semnal, Abundant,

Bogdana, Andrada, Lv9x and T7-15 obtained yields increases statistically interpreted as very significant and the varieties Ursita and Bezostaia obtained deficits yields statistically interpreted as being very significant negatives (*table 3*).

In the agricultural year 2020/2021 were obtained the highest yields for the wheat crop with values between 5798 kg/ha (line T42-17) and 10189 kg/ha (Semnal) (*table 3*).

Yields increases obtained were interpreted statistically as:

- very significant only for the Semnal variety which compared to the experience control has a yields difference of 1475 kg/ha;
 - distinctly significant for varieties Ursita, Voinic, Codru and at line T57-14 (table 3).

In the 2021/2022 agricultural year, yields were between 6584 kg/ha, for the Bezostaia variety and 9016 kg/ha for the Otilia variety (table 3).

Yields increases obtained were interpreted statistically as:

- negatively significant for the genotypes Bogdana, Bezostaia, Lv9x and T 42-17, which compared to the experience control has a yields difference of between 944 kg/ha (Bogdana) and 1746 kg/ha (Bezostaia) (table 3).

During the studied period. the Ursita variety had the lowest production. of 4527 kg/ha. in the 2019/2020 agricultural year and the Semnal variety had the highest production of 10189 kg/ha, in the 2020/2021 agricultural year (table 3).

Table 3

Productions recorded by wheat genotypes at A.R.D.S. Secuieni (2019/2022)

No.	Varieties	Yields 2019/2020			Yields 2020/2021			Yields 2021/2022		
		Kg/ha	Dif (kg/ha)	Semnif.	Kg/ha	Dif (kg/ha)	Semnif.	Kg/ha	Dif (kg/ha)	Semnif.
1	GLOSA	5347	Mt.		8714	Mt.		8330	Mt.	-
2	MIRANDA	5958	611	**	8376	-338		7851	-479	
3	OTILIA	6376	1029	***	7973	-741	°	9016	686	
4	PITAR	5780	433		7373	-1341	°	8171	-159	
5	SEMNAL	6603	1256	***	10189	1475	***	8535	205	
6	URSITA	4527	-820	°°°	9700	986	**	8746	416	
7	VOINIC	5446	99		9633	919	**	8719	389	
8	ABUNDENT	7243	1896	***	8945	231		8959	629	
9	BOGDANA	8081	2734	***	7396	-1318	°	7386	-944	°
10	Lv9X	6406	1059	***	8871	157		7008	-1322	°
11	ANDRADA	6180	833	***	8638	-76		8137	-193	
12	CODRU	5901	554	*	9717	1003	**	7944	-386	
13	T109-12	5712	365		8107	-607		7944	-386	
14	T57-14	6029	682	**	9659	945	**	8257	-73	
15	T7-15	7140	1793	***	8463	-251		8446	116	
16	T42-17	5996	649	**	5798	-2916		7102	-1228	°
17	Bezostaia	4620	-727	°°°	6908	-1806	°	6584	-1746	°
DL 5%		439 kg/ha			645 kg/ha			826 kg/ha		
DL 1%		595 kg/ha			876 kg/ha			1174 kg/ha		
DL 0.1%		797 kg/ha			1173 kg/ha			1700 kg/ha		

Regarding the quality of wheat genotypes. in the three agricultural years studied. the protein content was between 10.4% (Codru 2019/2020) and 17.0% (Bezostaia 2021/2022) and the gluten content varied between 20.1% and 35.3% in the same varieties and in the same years.

The starch content had values between 64.7% as recorded by the Bogdana variety in the 2020/2021 agricultural year and 69.8% a percentage recorded by the same variety, but in the 2019/2020 agricultural year, a drier year (table 4).

Table 4

Quality indices recorded in the studied wheat genotypes during the period 2019/2022 at A.R.D.S. Secuieni

No.	Varieties	Protein (%)			Gluten (%)			Starch (%)		
		2019 2020	2020 2021	2021 2022	2019 2020	2020 2021	2021 2022	2019 2020	2020 2021	2021 2022
1	GLOSA	13.1	13.3	15.1	26.2	26.9	31.0	68.2	68.6	67.3
2	MIRANDA	11.3	13.7	13.1	22.2	27.6	26.4	70.5	67.4	69.2
3	OTILIA	12.6	13.7	14.5	25.2	27.6	29.6	68.7	67.4	67.5
4	PITAR	13.5	14.4	16.0	27.4	29.3	33.2	68.0	67.4	66.3
5	SEMNAL	12.2	13.2	15.7	24.2	26.5	32.3	69.3	68.4	66.9
6	URSITA	12.2	13.4	14.7	24.3	27.1	30.2	69.3	68.4	61.8
7	VOINIC	13.6	14.2	13.9	27.5	29.0	28.1	68.1	67.0	67.8
8	ABUNDENT	11.2	13.8	15.5	22.0	27.8	32.0	69.3	67.7	66.8
9	BOGDANA	11.1	14.8	15.8	21.7	30.3	32.8	69.8	64.7	65.6
10	Lv9X	10.7	15.0	13.7	20.9	30.8	27.7	71.2	67.3	69.0
11	ANDRADA	10.6	14.2	15.1	20.6	28.9	30.9	70.6	67.1	66.9
12	CODRU	10.4	13.1	15.7	20.1	26.3	32.5	70.0	68.0	66.7
13	T109-12	10.7	14.1	14.7	20.8	28.6	30.2	69.1	66.7	67.0
14	T57-14	11.5	14.2	16.0	22.6	28.9	33.1	69.1	66.7	65.6
15	T7-15	12.2	13.9	14.3	24.1	28.1	29.2	68.7	67.4	67.9
16	T42-17	12.3	14.4	16.0	24.5	29.3	33.2	69.2	67.1	66.4
17	Bezostaia	13.6	14.4	17.0	27.4	29.3	35.3	68.5	67.6	66.8

Over the years' researchers have demonstrated that the quality indices are influenced by climatic conditions, crop technology and genotype.

The results presented in this paper regarding that the quality of winter wheat grains, in the three years of experimentation, are similar to those presented by Bîlteanu G. (1979) who concluded that grains from areas with dry climates are richer in protein substances while in climates more humid and cooler, where the period of fruit's development is longer, the grains accumulate starchier substances.

CONCLUSIONS

The following conclusions were drawn from the presented results:

- the average temperature is increasing while the precipitation is decreasing, which denotes a continuous global warming;
- throughout the experiments, it is worth noting the Ursita variety, which in 2019/2020 agricultural year obtained the lowest yield (4527 kg/ha) and the Semnal variety, which obtained the highest yield (10189 kg/ha) in 2020/2021 agricultural year;
- the protein content was between 10.4% as recorded in 2019/2020 agricultural year by the Codru variety and 17.0% as recorded by the Bezostaia variety in 2021/2022 agricultural year;
- the gluten content varied between 20.1% (Codru, agricultural year 2019/2020) and 35.3% (Bezostaia, agricultural year 2021/2022);

- the starch content had values between 64.7% as recorded for the Bogdana variety in the 2020/2021 agricultural year and 69.8%, a percentage recorded by the same variety, but in the 2019/2020 agricultural year who a drier year.

Climatic conditions greatly influence both, the productivity and the quality of wheat grains, as the presented results show.

ACKNOWLEDGMENTS

The present results were obtained within the framework of the ADER project no. 111/26.09.2019 – "Improving the structure of winter wheat varieties in the south and east of the country by creating and introducing varieties with higher and more stable production under climate change conditions and with quality corresponding to market requirements".

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