RESULTS REGARDING THE INFLUENCE OF VARIETY, SOIL TYPE AND CROP YEAR FACTORS ON THE PRODUCTION OF SPRING BARLEY GROWN IN NORTH-EAST BĂRĂGAN

REZULTATE PRIVIND INFLUENȚA FACTORILOR SOI, TIP DE SOL ȘI AN DE CULTURĂ ASUPRA PRODUCȚIEI DE ORZOAICĂ DE PRIMĂVARĂ CULTIVATĂ ÎN BĂRĂGANUL DE NORD-EST

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Abstract *This paper aims to study the influence of variety, soil type and climatic conditions on the production in spring barley. The research was conducted in 2008-2010, in Vădeni area, Brăila county, on two types of soil (typical chernozem and calcaric aluviosoil), on the varieties Annabell, Thuringia, Cristalia and Tunika.*
Keywords *barley varieties, production, soil*

Rezumat. *Lucrarea îşi propune studiul influenţei factorilor soi, tip de sol şi a condiţiilor climatice asupra producţiei la orzoaica de primăvară. Cercetările s-au efectuat în perioada 2008-2010, în zona Vădeni, judeţul Brăila, pe doua tipuri de sol (cernoziom tipic şi aluviosol calcaric), la soiurile Annabell, Thuringia, Cristalia, Tunika.*
Cuvinte cheie *soiuri de orz, producţie, sol*

INTRODUCTION

In order to increase the stability of the yields from year to year, new varieties of cereals must have a superior behaviour under both drought years and in years with normal or excess rainfall, i.e. they must combine high production potential and good resistance to water stress (Plum, 1996, quote by Săulescu N.N. et al., 2006).

MATERIAL AND METHOD

The research was conducted in 2008-2010, in Vădeni area, Brăila county, on two different types of soil, typical chernozem (with the following physical and chemical properties: bulk density (DA): 1.15 g/cm3, 28%, pH (water): 7.60, humus content (H): 3.5%, phosphorus (P_{AL}):45 ppm, Potassium (K_{AL}): 222 ppm and indicate N (IN): 3.55) and calcaric aluviosoil (with the following physical and chemical properties: bulk density (DA): 1.35 g/cm^3, pH (water): 7.75, humus content (H): 2.93%, Phosphorus (P_{AL}):47 ppm, Potassium (K_{AL}): 111 ppm and indicate N (IN): 2.93). Four varieties of spring barley were studied - Annabell, Thuringia, Cristalia and Tunika.

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The precedent plant was corn. The sowing was done in all the years of research, at the optimum age for this area (the first decade of March) at a density of 400 b.g./m^2.

Climatic conditions during the period in which the experiments took place were different from year to year (Table 1). Analysing the annual amount of rainfall compared to the multi-annual average (447 mm), it appears that the agricultural year 2007-2008 was a normal year (481 mm), 2008-2009 was dry (363 mm), 2009-2010 was a year with more precipitation (714 mm) irregularly distributed throughout the year.

In terms of average multi-annual temperatures recorded from the crop years during which the research was conducted compared to the normal (the multi-annual average calculated over 50 years) we can see that the crop years 2007-2008 and 2009-2010 were thermally normal years, registering a positive deviation of 0.7°C to the multi-annual averages. The agricultural year 2008-2009 was a warm year, registering a positive deviation of 1.2°C to the multi-annual averages.

Table1

The main climatic elements for the agricultural years 2007-2008, 2008-2009 and 2009-2010 compared to the normal

Elemente climatice		Valori lunare												Total/media an agricol
		X	XI	XII	I	II	III	IV	V	VI	VII	VIII	IX	
Precipitatii (mm)	Normala	31	36	33	27	27	29	36	52	63	47	42	29	447
	2007/2008	81	53	77	7	2	15	44	86	40	7	0	60	481
	Abatere	+50	+17	+44	-20	-25	-14	+18	+34	-23	-40	-42	+31	+34
	2008-2009	21	18	24	64	27	29	11	32	25	43	16	15	363
	Abatere	-10	-18	-9	+37	0	0	-25	-20	-38	-4	-26	-14	-84
	2009-2010	37	22	114	89	70	28	10	54	165	88	19	21	717
	Abatere	+6	-14	+81	+62	+43	-1	-26	+2	+102	+41	-23	-8	+270
Temperaturi in aer (°C)	Normala	11,7	5,6	0,4	-2,5	-0,3	4,6	10,9	16,9	20,7	22,8	22,1	17,5	10,9
	2007/2008	11,8	3,9	0,1	-1,3	2,6	8,3	12,3	16,3	21,6	22,9	24,3	16,3	11,6
	Abatere	+0,1	-1,7	-0,3	+1,2	+2,9	+3,7	+1,4	-0,3	+0,9	+0,1	+2,2	-1,2	+0,7
	2008-2009	12,1	6,6	3,3	0,3	2,5	5,6	11,5	17,5	21,4	24,5	22,6	17,6	12,1
	Abatere	+0,4	+1,0	+2,9	+2,8	+2,8	+1,0	+0,6	+0,6	+0,7	+1,7	+0,5	+0,1	+1,2
	2009-2010	12,8	7,2	0,2	-3,3	0,2	5,1	11,6	17,8	21,2	23,5	25,0	17,5	11,6
	Abatere	+1,1	+1,6	-0,2	-0,8	+0,5	+0,5	+0,7	+0,9	+0,5	+0,7	+2,9	0	+0,7

The researched observed the influence of the soil factor, the variety factor and crop year factor and also of the interactions between those factors on grain production in spring barley (Bîlteanu, 2003).

The experimental results were statistically processed by analysis of variance, the F test and limit differences (Săulescu and Săulescu, 1967). The production data capitalizing was done in a series, following the trifactorial model (2x4x3), as an experiment with two different soil types and four varieties grown in three years.

RESULTS AND DISCUSSION

The analysis of barley production was performed both in terms of influence of each analysed experimental factor, and the interactions between the three factors (soil, variety, crop year). In addition, the analysis of yields was made both by comparison with Thuringia variety – as the control variety (for each type of

soil and crop year) and the experimental average, by establishing the meanings of the differences.

Table 2

The analysis of variance and the F test for the three-year series

Cause of Variance	GL	SP	s^2	The F test		
				Compared to error	Compared to AB	Compared to BC
Total	23	2,93				
Soil type (A)	1	0,73	0,73	57,43** *(5,99; 13,74)*	525,90** (10,13; 13,74)	
Varieties(B)	3	0,43	0,14	11,18** *(4,76; 9,78)*	102,40** *(9,28; 29,46)*	3,14 (4,76; 9,78)
Crop years (C)	2	1,42	0,71	55,70** *(5,14; 10,92)*		205,02** (9,55; 30,82)
Interaction AxB	3	0,004	0,01	0,11 *(4,76; 9,78)*		
Interaction AxC	2	0,010	0,005	0,27		
Interaction BxC	6	0,27	0,045	3,56 *(4,28; 8,47)*		
Interaction AxBxC (error)	6	0,08	0,013			

The analysis of variance for grain yield in spring barley cultivated in 2008-2010, on two types of soil (chernozem and aluviosoil) reveals distinctly significant effects between soil types, between species and between crop years. Compared to the interaction of soil type with the variety (AxB), both the effects of soil and variety are distinctly significant. Compared the interaction of the variety with the crop year (BxC), only the effect of crop years is distinctly significant (Table 2).

Table 3

The influence of soil on spring barley production

Soil	Prod. (kg/ha)	Dev. from mt.		Signif.	Dev. from average		Signif.
		kg/ha	%		kgha	%	
Typical chernozem\(mt)	2495	mt	100		+133	105,6	*
Calcaric aluviosoil	2229	-266	89,3	00	-133	94,3	0
Average	2362				mt	100	
DL 5%=113 DL1%=170 DL 0,1%=274							

Regarding soil factor analysis (A) we see that the difference in production between the two soils is 266 kg/ha, thus being distinctly significant. Regarding the deviation from the average of the research, this is 133 kg/ha, being statistically significant (Table 3).

The Annabell variety had the best behaviour, achieving a distinctly significant deviation from the control variety Thuringia 267kg/ha.

Compared to the average of the varieties, the Annabell variety showed a distinctly significant increase of production by 246 kg/ha, while on the opposite

side, the Cristalia variety showed a distinctly significant deviation in production, this time lower than 246 kg/ha (Table 4).

Table 4

The influence of variety on the production of spring barley

Variety	Prod. (kg/ha)	Dev. from mt.		Signif.	Dev. from the average		Signif.
		kg/ha	%		kg/ha	%	
Thuringia (mt)	2,341	mt	100		-21	99,1	-
Annabell	2,608	+267	111,4	**	+246	110,4	**
Cristalia	2,116	-225	90,3	0	-246	89,5	00
Tunika	2383	+42	101,7	-	+21	100,8	-
Average	2362				mt	100	
DL 5%=159 DL1%= 241 DL 0,1%=388							

Table 5

Influence of the crop year on the production of spring barley

Crop year	Prod. (kg/ha)	Dev. from mt.		Signif.	Dev. from the average		Signif.
		kg/ha	%		kg/ha	%	
2008	2702	mt	100		+341	114,4	***
2009	2153	-549	79,6	000	-208	91,1	00
2010	2230	-472	82,5	000	-131	94,4	-
Average	2361				mt	100	
DL 5%=138 DL1%=208 DL 0,1%=336							

The data in Table 5 shows that, compared to the average yield obtained in 2008, as a control year, the climatic conditions in the other two years of research were less favourable, so that the average production was lower than in the control year, this being very significant statistically. Compared to the average of all years, 2008 registered a very significant production level of 2702 kg/ha, and in contrast to this was year 2009, with a production of 2153 kg/ha, respectively a distinctly significant difference of 208 kg/ha.

Table 6

The influence of soil type x variety interaction on the production of spring barley

Variety – soil		Prod. (kg/ha)	Dev. from mt.		Signif.	Dev. from the average		Signif.
			kg/ha	%		kg/ha	%	
Thuringia (mt)	C	2483	mt	100		+6	100,2	
	A	2200	mt	100		-277	88,8	0
Annabell	C	2758	+275	111,07	*	+281	111,3	*
	A	2458	+258	110,72	*	-19	99,2	-
Cristalia	C	2242	-241	90,29	0	-235	90,5	00
	A	1992	-208	90,54	-	-485	80,4	00
Tunika	C	2500	+17	100,68	-	+23	100,9	-
	A	2,66	+66	103,00	-	-211	91,4	-
Average		2,77				mt	100	
DL 5%=225 DL1%=341 DL 0,1%=548								

C^* - typical chernozem, A^* - calcaric aluviosoil

Analysing the data in Table 6 we see that: compared to the control variety Thuringia, only the Annabell variety obtained a significant production increase on both soil types, and compared to the research average, significant inferior differences were obtained for the Cristalia variety on both soil types and the Thuringia variety grown on aluviosoil. The Annabell variety grown on chernozem obtained a significant production increase of 277 kg/ha from the average of the research.

Table 7

The influence of variety x crop year interaction on the production of spring barley

Variety	Crop year	Prod. (kg/ha)	Dev. from mt.		Signif.	Dev. from the average		Signif.
			kg/ha	%		kg/ha	%	
Thuringia (mt)	2008	2612	mt	100		+250	110,5	-
	2009	2250	mt	100		-112	95,2	-
	2010	2162	mt	100		-200	91,5	-
Annabell	2008	3025	+413	115,81	*	+663	128,0	**
	2009	2337	+87	103,86	-	-25	98,9	-
	2010	2462	+300	103,87	*	+100	104,2	-
Cristalia	2008	2350	-262	89,96	-	-12	99,5	-
	2009	2062	-188	91,64	-	-300	87,2	0
	2010	1937	-225	89,59	-	-425	82,0	00
Tunika	2008	2825	+213	108,15	-	+463	119,6	**
	2009	1962	-288	87,72	0	-400	83,0	00
	2010	2362	+200	109,25	-	0	100	
Average		2362				mt	100	
DL 5%=275 DL1%=418 DL 0,1%=672								

The data presented in Table 7 shows the following: compared to the control variety, Thuringia, there were significant production increases in the variety Annabell in 2008 and 2010. The best yields were obtained from varieties Annabell and Tunika in 2008 with a distinctly significant difference 663 kg/ha, respectively 463 kg/ha compared to the research average.

Table 8

The influence of soil type x variety x crop year on the production of spring barley

Soil	Variety	Crop year	Prod. (kg/ha)	Dev. from mt.		Signif.	Dev. from the average		Signif.
				kg/ha	%		kg/ha	%	
Typical Chernozem	Thuringia (mt)	2008	2725	mt	100		+362	115,3	***
		2009	2400	mt	100		+37	101,5	-
		2010	2325	mt	100		-38	98,3	-
	Annabell	2008	3075	+350	112,84	***	+712	130,1	***
		2009	2450	+50	102,08	-	+87	103,6	*
		2010	2750	+425	118,27	***	+387	116,3	***
	Cristalia	2008	2450	-275	89,90	000	+87	103,7	*
		2009	2200	-200	91,66	000	-163	93,1	00
		2010	2075	-250	89,24	000	-288	87,8	000

	Tunika	2008	3025	+300	111,00	***	+662	128,0	***
		2009	2050	-350	85,41	000	-313	86,7	000
		2010	2425	+100	104,30	*	+62	102,6	-
Calcaric Aluviosoil	Thuringia	2008	2500	mt	100		+137	105,7	**
		2009	2100	mt	100		-263	88,8	000
		2010	2,000	mt	100		-363	84,6	000
	Annabell	2008	2975	+475	119	***	+612	125,8	***
		2009	2225	+125	105,95	**	-138	94,1	00
		2010	2175	+175	108,75	**	-188	92,0	0
	Cristalia	2008	2250	-250	90,00	000	-113	95,2	0
		2009	1925	-175	91,66	00	-438	81,4	000
		2010	1800	-200	90,00	000	-563	76,1	000
	Tunika	2008	2625	+125	105,00	**	+262	111,0	**
		2009	1875	-225	89,28	000	-488	79,3	000
		2010	2300	+300	115,00	***	-63	97,3	-
average			2363				mt	100	
DL 5%=79 DL1%=120 DL 0,1%=194									

Analysing the data in Table 8 the following fact emerges: the highest yields were obtained on chernozem, for the varieties Annabell and Tunika in 2008.

CONCLUSIONS

1. The varieties tested reacted differently to environmental factors, 2008 was the most favourable year, followed by 2010 and 2009 was the most unfavourable.

2. Annabell and Tunika varieties have proven to be superior to the control variety, Thuringia, in terms of production obtained in all three years of research, both on chernozem and aluviosoil, which recommends them for the studied area.

3. The yields obtained on chernozem are higher than those obtained on aluviosoil.

REFERENCES

1. **Bîlteanu Gh**., **2003** - *Fitotehnie ediția a II a*, Edit. Agro-Silvică de stat, Bucureşti, p. 183-210.
2. **Săulescu N.A., Săulescu N.N**., **1967** - *Câmpul de experiență- ediția a II a*, Edit. Agro-Silvică de Stat, Bucureşti.
3. **Săulescu N.N., și colab**., **2006** - *Comportarea unor soiuri de grău de toamnă românești în condițiile contrastante de aprovizionare cu apă*, Probleme de genetică teoretică și aplicată, XXXVIII, vol. 1-2, p. 21-29.