Scientific Papers. Series A. Agronomy, Vol. LXIII, No. 1, 2020
ISSN 2285-5785; ISSN CD-ROM 2285-5793; ISSN Online 2285-5807; ISSN-L 2285-5785

INFLUENCE OF DIFFERENTIATED FERTILIZATION ON YIELD AND QUALITY OF WINTER WHEAT CULTIVATED ON THE ȘIMNIC LUVOSOIL

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Abstract

Between 2016-2018, 15 varieties of winter wheat were tested in 3 variants of fertilization (V1 = unfertilized, V2 = $N_{40}P_{40}$ administered in autumn and V3 = $N_{100}P_{40}$ administered in autumn + spring) on Simnic luvosoil. The following were analyzed: yield, thousand grains weight, test weight, protein content and sedimentation index. Wheat yield was significantly higher when the nitrogen dose increased from N_0 to N_{40} and from N_0 to N_{100}. All tested varieties, without exception, registered a statistically assured protein increase when the nitrogen dose was increased to N_{100}.The correlation between the protein content obtained in the unfertilized variant and the protein content when fertilized with $N_{40}P_{40}$ is extremely strong (r = 0.912). For the studied interval, the coefficient of determination suggests that approximately 83% of the variability of the protein content to $N_{40}P_{40}$ is associated with the protein content from the unfertilized variant. Also, the correlation between the protein content obtained in the unfertilized variant and the protein content when fertilized with N100P40 is positive and extremely strong (r = 0.877). Approximately 77% of the variability of the protein content at $N_{100}P_{40}$ is associated with the protein content in the unfertilized variant.

Key words: *wheat, quality, fertilization levels, yield, protein.*

INTRODUCTION

Nitrogen is the main factor in growth and development of plants, with positive influence on rooting, tillering, leaf system development and photosynthesis process, the elements of productivity and also quality (Matei, 2014). It is understood that in addition to nitrogen, the other nutrients play a role in the balanced nutrition of wheat, in which phosphorus is an important role. In fact, the highest yields are obtained when fertilizing using these two types of fertilizers (Naidin & Păunescu, 2003).
Under the climatic conditions specific to Câmpia Română, the wheat satisfies the nitrogen needs necessary for growth and development, especially by absorbing large quantities of nitrates, as nitrogen in the form of ammonium ions is converted quickly into nitrates, and their dynamics in soil is dependent on the weather (Nedelciuc et al., 1995).
Therefore, the application of nitrogen fertilizers becomes a necessary and obligatory measure for the continuous supply of plants with this essential nutrient and especially under irrigation conditions (Nicolescu et al., 1994).
The harvest results obtained on the cambic chernozem from Câmpia Banato-Crișană showed that even on this type of soil with good fertility, doubling the dose of nitrogen fertilizers from N70 to N140, on the basis provided by P80K80 is motivated, the average harvest increase per 3 genotypes studied being 12% (+565 kg/ha), statistically assured as very significant. Wheat varieties of the species *Triticum aestivum* ssp. *vulgare* (Vill.), Ciprian and Kristina registered 5997 kg/ha and 6499 kg/ha, respectively, average yields on the two agrofonds (Andronache, 2010).
The highest positive correlations were between yield and grain weight/spike, yield and HW and HW and grain weight/spike. For those characters there were also identified a very positive correlation with the N doses (Iancu et al., 2019).
Seventeen winter wheat cultivars were tested with recommended and reduced N fertilization during 4 years in three locations. Relative grain yield, protein concentration and protein yield per hectare under reduced fertilization, as percentage from the performance with recommended N fertilization, showed very

large variation due to environment, the effect of cultivars being much smaller, but still significant. The effect of reduced N fertilization was larger for grain yield than for protein concentration. For grain yield and protein yield per hectare the highest reduction was found in cultivars originating from the Fundulea breeding program, while the smallest reduction was found in cultivar Adelina (bred at Şimnic), suggesting a possible relationship with the natural soil fertility at the breeding site (Marinciu et al., 2018).

MATERIALS AND METHODS

The experience was placed in the experimental field of the Breeding Laboratory at ARDS Simnic. Between 2016 and 2018, 15 varieties of winter wheat (A factor) were tested in 3 fertilization level (B factor): V1 = unfertilized, V2 = $N_{40}P_{40}$ administered in autumn and V3 = $N_{100}P_{40}$ administered in autumn + spring, on Simnic luvosoil.

The following were analyzed: yield, thousand grains weight, test weight, protein content and sedimentation index.

Each variant was placed in 3 repetitions on a plot with 10.5 sm surface which 9 sm were harvested.

Calculated and interpreted: influence of A factor (variety), influence of B factor (fertilization level), interaction variety x fertilization level (A x B - between fertilization levels at the same variety) and interaction fertilization level x variety (B x A - between varieties at the same fertilization level).

The protein content was determined with the infrared apparatus INFRATEC, test weight with GRANOMAT, TGW with CONTADOR (grains count) and the sedimentation index according to the Zeleny method.

The grain yield was calculated at STAS humidity (14%).

The climatic conditions, except for 2016, provided the necessary precipitation for the normal development of wheat crops.

RESULTS AND DISCUSSIONS

Yield. Among the management technologies, nitrogen fertilization is the most important for increasing grain yield in cereals (Flores et al., 2012; Arenhardt et al., 2015). In wheat, thenutrient is responsible for the formation of biological molecules and determinant of productivity and grain quality (Fageria et al., 2006; Silva et al., 2015).

Important results regarding wheat yield depending on nitrogen fractionation during crop fertilization presented Brezolin et al. in 2017.

In our experiment, the yield limits at the dose of N100P40 were between 5644 kg/ha in the Ursita variety and 4014 kg/ha in Bezostaia, on average for 3 years. At the dose of $N_{40}P_{40}$ the highest yield was recorded byUnitar variety (5002 kg/ha) and the smallest of the same variety Bezostaia (3667 kg/ha). In the unfertilized, yield limit was 3274 kg/ha in the Alex variety (Ursita is very close with 3242 kg/ha) and 2707 kg/ha in Bezostaia.

Over 5500 kg/ha was reached only at the increased dose of nitrogen by the Ursita and Unitar varieties. Very close was the variety Adelina.

All the varieties studied had very significant yield increases when the nitrogen dose increased either to N_{40} or to N_{100} on the basis of P_{40} (Table 1).

Overall, yield of wheat was significantly higher when the nitrogen dose was increased from N_0 to N_{40} and from N_0 to N_{100} (+1313 kg/ha, respectively 2087 kg/ha).

Regardless of the level of fertilization, the yield of the tested varieties was at the control level - the Glosa variety, with the exception of the Bezostaia variety (a landmark for genetic progress over time) whose yield was distinctly significantly diminished.

At the N_0P_0 fertilization level, the Bezostaia variety recorded a yield significantly lower than the control variety, which indicates that it does not support the absence of nitrogen as well.

Table 1. Differentiated fertilization influence on yield at tested varieties (2016-2018 average)

A factor (variety)	B factor (fertilizationlevel)					
	Yield at N0P0 (kg/ha) -b_1(ct)-	Yield at N40P40 (kg/ha) -b_2-	Yield at N100P40 (kg/ha) -b_3-	A x B dif b_2-b_1	A x B dif b_3-b_1	A factor influ ence
	B x A					
-a_1-GLOSA(ct)	3181	4193	5156	1012 ***	1975 ***	4177
-a_2-BOEMA 1	2981	4277	5035	1296 ***	2054 ***	4098
-a_3-LITERA	3198	4219	4851	1021 ***	1652 ***	4089
-a_4-MIRANDA	3099	4225	5462	1126 ***	2363 ***	4262
-a_5-IZVOR	3029	3839	4545^{oo}	810 ***	1517 ***	3804
-a_6-OTILIA	3041	4415	5251	1374 ***	2210 ***	4236
-a_7-PITAR	3011	4228	5071	1217 ***	2060 ***	4103
-a_8-PAJURA	3108	4230	5406	1122 ***	2298 ***	4248
-a_9-URSITA	3242	4734**	5664**	1492 ***	2422 ***	4547
-a_{10}-UNITAR	3131	5002 ***	5616*	1871 ***	2485 ***	4583
-a_{11}-PROFUND	3060	4763**	5449	1703 ***	2390 ***	4424
-a_{12}-ADELINA	2872	4665*	5492	179 4***	2621 ***	4343
-a_{13}-S 60	3109	4626*	5221	151 6***	2111 ***	4319
-a_{14}-ALEX	3274	4647*	5118	1373 ***	1845 ***	4346
-a_{15}-BEZOSTAIA	2707^{o}	3677^{oo}	4014^{ooo}	969 ***	1307 ***	3466^{oo}
Average	3070	4383	5157			
B factor influence	ct	1313^{***}	2087^{***}			

A factor: DL 5% = 470 kg/ha; DL 1% = 620 kg/ha; DL 0.1% = 810 kg/ha
B factor: DL 5% = 200 kg/ha; DL 1% = 300 kg/ha; DL 0.1% = 430 kg/ha
A x B interaction: DL 5% = 350 kg/ha; DL 1% = 460 kg/ha; DL 0.1% = 600 kg/ha
B x A interaction: DL 5% = 370 kg/ha; DL 1% = 500 kg/ha; DL 0.1% = 650 kg/ha

At the $N_{40}P_{40}$ level of fertilization, recent creations of the breeding process were highlighted as superior to the Glosa variety: Ursita, Unitar, Profund, Adelina, Şimnic 60 and the Alex variety from the old varieties.
Increasing the nitrogen dose to N_{100} on P_{40} base favored the Ursita and Unitar varieties, which obtained higher yields than the Glosa variety, with statistical assurance. Izvor variety had a significantly reduced yield compared to the same control variety.
The Bezostaia variety was inferior to the Glosa variety, with statistical assurance at each of the studied fertilization levels.
There is a positive close correlation between the yield obtained when fertilized with N40P40 and the yield obtained when not fertilized (r = 0.453). For the interval studied, the correlation suggests that when an increase of yield by 100 kg/ha occurs in the unfertilized, at $N_{40}P_{40}$ the increase is 118 kg/ha (Figure 1).

About 23% of yield variability at $N_{40}P_{40}$ is associated with yield at N_0P_0. As the latter grows, grow yield in nitrogen addition plots.
The varieties Ursita and Alex were noted that had very high yields in both fertilization variants.

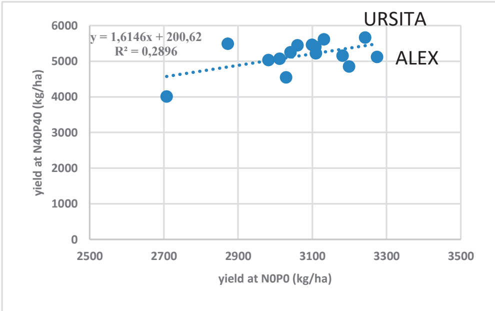

Figure 1. Correlation between N_0P_0 yield and N40P40 yield (r = 0.475)

The correlation between the yield obtained when fertilized with $N_{100}P_{40}$ and the yield obtained when not fertilized (r = 0.538) is stronger. For the studied interval, the correlation suggests that when an increase of yield by 100 kg/ha occurs in the unfertilized, at $N_{100}P_{40}$ the increase is 161 kg/ha (Figure 2). About 29% of yield variability at $N_{100}P_{40}$ is associated with yield at N_0P_0. And here, as the latter grows, grows yield in the variant with the higher dose of nitrogen.
The varieties Unitar, Alex and Ursita were noted, which had very high yields in both variants (unfertilized and $N_{100}P_{40}$).

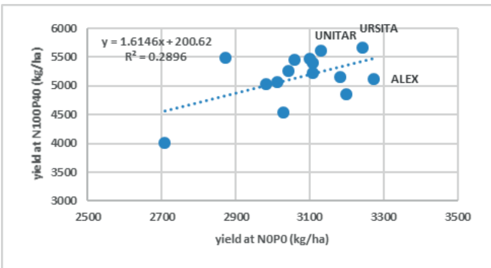

Figure 2. Correlation between N_0P_0 yield and $N_{100}P_{40}$ yield (r = 0.538)

Test weight (TW). Under the experimentation conditions, not all the varieties tested obtained TW above limit of 76 kg/hl (Table 2).There are several varieties where the test weightdecreased with statistical assurance when the nitrogen dose was increased: Miranda (-1.8/-2.0 kg/hl), Izvor (-1.4/-1.3 kg/ hl), Unitary (-1.2 kg/hl), Adelina (-1.3 kg/hl), S60 (-1.4/-2.1 kg/hl) and Alex (-1.2/-1.3 kg/hl).

Table 2. Differentiated fertilization influence on test weight at tested varieties (2016-2018 average)

A factor (variety)	B factor (fertilizationlevel)					
	TW at N0P0 (kg/hl) -b_1- (ct)	TW at N40P40 (kg/hl) -b_2-	TW at N100P40 (kg/hl) -b_3-	A x B dif b_2-b_1	A x B dif b_3-b_1	A factor influ ence
		B x A				
-a_1-GLOSA (ct)	75.9	75.8	76.2	-0.2	0.2	76.0
-a_2-BOEMA 1	76.1	75.8	76.9	-0.3	0.8	76.3
-a_3-LITERA	76.0	75.4	75.9	-0.7	-0.1	75.8
-a_4-MIRANDA	75.9*	74.1^{o}	73.9^{ooo}	-1.8^{oo}	-2.0^{oo}	74.6^{o}
-a_5-IZVOR	77.5*	76.1	76.2	-1.4^{oo}	-1.3^{o}	76.6
-a_6-OTILIA	77.2	76.2	76.7	-0.9	-0.4	76.7
-a_7-PITAR	76.8	75.7	76.5	-1.1	-0.3	76.3
-a_8-PAJURA	75.2	75.9	76.8	0.7	1.6**	76.0
-a_9-URSITA	74.2^{o}	77.4*	77.7*	3.2***	3.5 ***	76.4
-a_{10}-UNITAR	75.3	74.1^{o}	74.8^{o}	-1.2^{o}	-0.5	74.8^{o}
-a_{11}PROFUND	76.9	76.0	76.2	-0.9	-0.7	76.4
-a_{12}-ADELINA	77.4*	76.1	76.8	-1.3^{o}	-0.6	76.7
-a_{13}-S 60	76.9	75.6	74.8^{o}	-1.4^{o}	-2.1^{ooo}	75.8
-a_{14}-ALEX	75.9	74.7	74.5^{o}	-1.2^{o}	-1.3^{o}	75.0
-a_{15}-BEZOSTAIA	76.4	77.2*	77.4	0.8	1.0	77.0
Average	76.2	75.7	76.1			
B factor influence	ct	-0,5^{o}	-0,1			

A factor: DL 5% = 1.2 kg/hl; DL 1% = 1.6 kg/hl; DL 0.1% = 2.1 kg/hl
B factor: DL 5% = 0.5 kg/hl; DL 1% = 0.7 kg/hl; DL 0.1% = 1.1 kg/hl
A x B interaction: DL 5% = 1.2 kg/hl; DL 1% = 1.6 kg/hl; DL 0.1% = 2.1 kg/hl
B x A interaction: DL 5% = 1.3 kg/hl; DL 1% = 1.8 kg/hl; DL 0.1% = 2.3 kg/hl

On 3 years average, the lowest value was obtained by the Miranda variety (73.9 kg/hl) at $N_{100}P_{40}$.

The study of the influence of the variety, regardless of the level of fertilization, revealed that the variety Glosa was not significantly exceeded and the varieties Miranda and Unitar were significantly lower.

Surprisingly, increasing the nitrogen dose significantly decreased the test weightin variants on the basis of $N_{40}P_{40}$ and kept it approximately equal to the dose of $N_{100}P_{40}$.

At the N_0P_0 fertilization level, the Miranda, Izvor, Adelina varieties were higher than the control and the Ursita variety was significantly lower than this indicator.

At the $N_{40}P_{40}$ fertilization level, the varieties Ursita and Bezostaia were highlighted as superior on Glosa.

Increasing the nitrogen dose to N_{100} on the P_{40} base favored only the Ursita variety. And the Pajura variety presented the upper TW but only at $N_{100}P_{40}$. The varieties Miranda, Unitar, Șimnic 60 and Alex were inferior with statistical assurance in relation to the same control variety.

The Ursita variety was the only variety superior to the Glosa variety in point of view of the values of the test weight, with statistical assurance at the nitrogen fertilization levels. In contrast, the varieties Miranda, Izvor, Șimnic 60 and Alex registered decreases with statistical assurance in the conditions of increasing either 40 or 100 kg/ha of the nitrogen dose. In conclusion, the test weight is more influenced by the interaction variety x fertilization level than unique contribution of nitrogen.

The 1000 grains weight (TGW). The 1000 grains weight had very high values during the three years of experimentation, at all three levels of fertilization (over 39 g/1000 grains). The values of this element of productivity were between 39.3 g at the Otilia variety and 47.3 g atthe Unitar in variant without nitrogen; between 42.4 g at the Otilia variety and 51.3 g at Profund line in the $N_{40}P_{40}$ variant; between 39.9 g at Alex and 50.4 g at Profund in the $N_{100}P_{40}$ variant (Table 3).

Table 3. Differentiated fertilization influence on 1000 grains weight at tested varieties (2016-2018 average)

A factor (variety)	B factor (fertilizationlevel)					
	TGW at N0P0 (g) -b_1- (ct)	TGW at N40P40 (g) -b_2-	TGW at N100P40 (g) -b_3-	A x B dif b_2-b_1	A x B dif b_3-b_1	A factor influ ence
		B x A				
-a_1-GLOSA (ct)	46.0	49.2	46.8	3.2*	0.8	47.3
-a_2-BOEMA 1	41.8^{ooo}	43.3^{ooo}	42.4^{ooo}	1.5	0.6	42.5^{oo}
-a_3-LITERA	42.0^{oo}	44.7^{ooo}	43.9^{o}	2.7*	2.0	43.5^{o}
-a_4-MIRANDA	45.1	48.5	46.2	3.4**	1.0	46.6
-a_5-IZVOR	42.3^{oo}	45.9^{oo}	42.6^{ooo}	3.5**	0.3	43.6^{o}
-a_6-OTILIA	39.3^{ooo}	42.4^{ooo}	40.5^{ooo}	3.1*	1.2	40.7^{ooo}
-a_7-PITAR	44.3	45.4^{oo}	45.1	1.0	0.7	44.9
-a_8-PAJURA	44.0	47.4	44.8	3.4**	0.8	45.4
-a_9-URSITA	44.4	44.8^{ooo}	45.9	0.4	1.5	45.1
-a_{10}-UNITAR	47.3	46.5^{o}	45.2	-0.8	-2.0	46.3
-a_{11}PROFUND	46.5	51.3*	50.4**	4.8***	3.9 ***	49.4
-a_{12}-ADELINA	41.9^{ooo}	45.4^{oo}	43.7^{ooo}	3.5**	1.8	43.6^{o}
-a_{13}-S 60	46.6	47.2	47.1	0.6	0.6	47.0
-a_{14}-ALEX	39.4^{ooo}	47.6	39.9^{ooo}	8.2***	0.5	42.3^{oo}
-a_{15}-BEZOSTAIA	42.2^{oo}	44.8^{ooo}	43.6^{oo}	2.6*	1.4	43.5^{o}
Average	43.5	46.3	44.5			
B factor influence	ct	2,8	1,0			

A factor: DL 5% = 3.5 g; DL 1% = 4.7 g; DL 0.1% = 6.1 g
B factor: DL 5% = 3.3 g; DL 1% = 4.4 g; DL 0.1% = 5.7 g
A x B interaction: DL 5% = 2.5 g; DL 1% = 3.3 g; DL 0.1% = 4.3 g
B x A interaction: DL 5% = 2.4 g; DL 1% = 3.1 g; DL 0.1% = 4.1 g

The increase of the nitrogen dose had a very significant influence only at the Profund line (+3.9 g at $N_{100}P_{40}$ and +4.8 g at $N_{40}P_{40}$).At the $N_{40}P_{40}$ dose, increases of TGW with statistical assurance had the majority of varieties.

The results suggest that the nitrogen dose does not influence the 1000 grains weight, although there are increases, they do not have statistical assurance.

The influence of the variety, regardless the fertilization level, exits and is reflected in the fact that five of the varieties tested are inferior to the variety Glosa: Boema, Litera, Izvor, Otilia, Adelina, Alex and Bezostaia.

Also, the interaction fertilization level x variety revealed that the varieties Boema, Litera, Izvor, Otilia, Adelina and Bezostaia have a 1000 grains weight inferior with statistical assurance at all fertilization levels. In contrast, in the presence of nitrogen, Profund wheat line is over Glosa with statistical assurance, on a 3 years average. In conclusion, the 1000 grains weight is not influenced by the fertilization level but is influenced by the variety because it is a genetic impregnated character.

Protein content (PC). Under experimentation conditions, only two of the varieties had a protein content above the 10.5% limit at the N100P40 variant (Profund - 10.9% and Bezostaia - 10.7%). In the unfertilized variant, the protein content was between 8.3% (Miranda) and 10% in Bezostaia; in the fertilized variant with $N_{40}P_{40}$, the values of the protein content were between 8.9% at several varieties and 10.4% at Profund line (its name comes from the combination "protein (pro) Fundulea (fund)", which represents the variety with the largest protein content created at NARDI Fundulea) and for the variant fertilized with $N_{100}P_{80}$ the limits were 9.4% (Unitar) and 10.9% (Profund), on 3 years average (Table 4).

All varieties, without exception, registered a statistically assured increase in protein when the nitrogen dose was increased to N_{100}.

The obtained results suggest that the high quantity of nitrogen influences the protein content, with increases between 0.7-1.5%.

At two levels of fertilization, the varieties Profund and Bezostaia were superior to the control variety Glosa. The fact that the Bezostaia variety was superior in the absence of nitrogen indicates that it is genetically impregnated with a high protein content.

Table 4. Differentiated fertilization influence on protein content at tested varieties (2016-2018 average)

A factor (variety)	B factor (fertilizationlevel)					
	PC at N0P0 (%) -b_1- (ct)	PC at N40P40 (%) -b_2-	PC at N100P40 (%) -b_3-	A x B dif b_2-b_1	A x B dif b_3-b_1	A factor influ ence
	B x A					
-a_1-GLOSA (ct)	9.3	9.5	10.2	0.2	0.8**	9.7
-a_2-BOEMA 1	9.3	9.3	10.1	0.0	0.8**	9.6
-a_3-LITERA	9.0	9.4	10.0	0.4	1.0**	9.4
-a_4-MIRANDA	8.3^{oo}	8.9	9.8	0.6*	1.5***	9.0
-a_5-IZVOR	9.1	9.6	10.3	0.5	1.3***	9.7
-a_6-OTILIA	8.7	9.1	9.7	0.4	1.0**	9.2
-a_7-PITAR	9.4	9.6	10.0	0.2	0.7*	9.7
-a_8-PAJURA	9.1	9.2	10.0	0.1	1.0**	9.4
-a_9-URSITA	8.6^{o}	9.0	9.6	0.4	1.0**	9.1
-a_{10}-UNITAR	8.6^{o}	8.8^{o}	9.4^{o}	0.2	0.7*	8.9^{o}
-a_{11}PROFUND	9.8	10.4**	10.9*	0.5	1.1 ***	10.4
-a_{12}-ADELINA	9.0	9.0	9.7	0.0	0.7*	9.2
-a_{13}-S60	8.8	8.9	9.6	0.1	0.7*	9.1
-a_{14}-ALEX	8.7	8.9	9.7	0.3	1.0**	9.1
-a_{15}-BEZOSTAIA	10.0*	10.2*	10.7	0.2	0.7*	10.3
Average	9.0	9.3	10.0			
B factor influence	ct	0,3	1,0***			

A factor: DL 5% = 0.8%; DL 1% = 1.1%; DL 0.1% = 1.4%
B factor: DL 5% = 0.5%; DL 1% = 0.6%; DL 0.1% = 0.8%
A x B interaction : DL 5% = 0.6% ; DL 1% = 0.8%; DL 0.1% = 1.1%
B x A interaction : DL 5% = 0.7%; DL 1% = 0.9%; DL 0.1% = 1.1%

Miranda variety much better utilized a reduced amount of nitrogen in relation to all its varieties.

The correlation between the protein content obtained in the unfertilized variant and the protein content when fertilized with $N_{40}P_{40}$ is extremely strong (r = 0.912) (Figure 3).

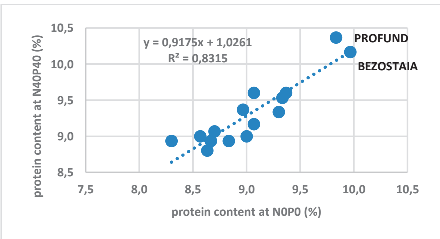

Figure 3. Correlation between protein content at N0P0 and protein content at $N_{40}P_{40}$ (r = 0.912)

For the studied interval, the coefficient of determination suggests that approximately 83% of the variability of the protein content to $N_{40}P_{40}$ is associated with the protein content from the unfertilized variant Profund and Bezostaia varieties with high protein content were noted in both variants.

Also, the correlation between the protein content obtained in the unfertilized variant and the protein content when fertilized with $N_{100}P_{40}$ is positive and extremely strong (r = 0.877). Approximately 77 % of the variability of the protein content at $N_{100}P_{40}$ is associated with the protein content in the unfertilized variant (Figure 4).

The same two varieties were noticed: Profund and Bezostaia.

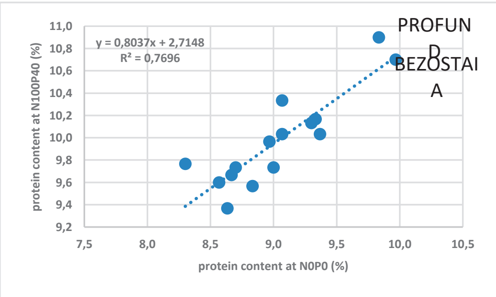

Figure 4. Correlation between protein content at N_0P_0 and protein content at $N_{100}P_{40}$ (r = 0.877)

Sedimentation index. With three exceptions (Miranda, Şimnic 60 and Alex at N_0P_0) in all the fertilization variants, the varieties tested had the sedimentation index over 60 ml, the limit for a good flour for baking.

The sedimentation index values at the nitrogen dose N_{100} on the P_{40} basis were within 70 ml at Miranda and 84 ml at Otilia variety, while at the nitrogen dose N_{40} on the P_{40} basis, the interval was 61 ml (Miranda) - 81 ml (Profund). In the unfertilized, the limits were 53 ml at Miranda and 79 ml at Profund (Table 5).

Pitar and Profund varieties were superior to the Glosa control variety at all fertilization levels, while Miranda, Izvor and Şimnic 60 were lower - in both cases, with statistical assurance.

Exist an influence of the variety but also an influence of the fertilization level on the sedimentation index. The varieties Otilia, Pitar, Profund and Bezostaia presented a higher sedimentation index with statistical assurance compared to the Glosa variety, while the Litera, Miranda, Izvor, Pajura, Alex and Şimnic 60 varieties had diminished values with statistical assurance.

The obtained results show that during the three years of experimentation, the quality of baking reflected through the sedimentation index was very good and the presence of nitrogen in high dose brings very significant increases of this indicator (+4 ml at $N_{40}P_{40}$ and 10 ml at $N_{10}P_{40}$).

Table 5. Differentiated fertilization influence on sedimentation index at tested varieties (2016-2018 average)

A factor (variety)	B factor (fertilizationlevel)					
	SI at N0P0 (%) $-b_1-$ (ct)	SI at N40P40 (%) $-b_2-$	SI at N100P40 (%) $-b_3-$	A x B dif b_2-b_1	A x B dif b_3-b_1	A factor influ ence
	B x A					
$-a_1-$GLOSA (ct)	68	71	77	4*	10***	72
$-a_2-$BOEMA 1	61^{ooo}	65^{ooo}	75	4*	14***	67^{o}
$-a_3-$LITERA	61^{ooo}	68	73^{oo}	8**	12***	67^{o}
$-a_4-$MIRANDA	53^{ooo}	61^{ooo}	70^{ooo}	8***	17***	61^{ooo}
$-a_5-$IZVOR	60^{ooo}	66^{oo}	68^{ooo}	7***	8***	64^{oo}
$-a_6-$OTILIA	77***	72	84***	-5^{oo}	7***	77*
$-a_7-$PITAR	74***	77***	82**	4*	8***	77*
$-a_8-$PAJURA	62^{ooo}	65^{ooo}	74	4*	13***	67^{o}
$-a_9-$URSITA	65	67^{o}	75	2	10***	69
$-a_{10}-$UNITAR	67	66^{oo}	71^{ooo}	-1	4*	68
$-a_{11}-$PROFUND	79***	81***	81*	3	2	80**
$-a_{12}-$ADELINA	63^{oo}	68	75	5**	12***	69
$-a_{13}-$SIMNIC 60	57^{ooo}	67^{o}	72^{oo}	10 ***	15***	65^{o}
$-a_{14}-$ALEX	58^{ooo}	64^{ooo}	76	7***	19***	66^{o}
$-a_{15}-$BEZOSTAIA	77***	73	81*	-4^{o}	4*	77*
Average	65	69	75			
B factor influence	**ct**	**4*** **	**10*** **			

A factor: DL 5% = 5 ml; DL 1% = 6 ml; DL 0.1% = 8 ml
B factor: DL 5% = 2 ml; DL 1% = 3 ml; DL 0.1% = 4 ml
A x B interaction: DL 5% = 4 ml; DL 1% = 5 ml; DL 0.1% = 6 ml
B x A interaction: DL 5% = 4 ml; DL 1% = 5 ml; DL 0.1% = 6 ml

CONCLUSIONS

All the varieties studied had very significant yield increases when the nitrogen dose increased either to N_{40} or to N_{100} on the basis of P_{40}. About 23% of yield variability at $N_{40}P_{40}$ is associated with yield at N_0P_0. As the latter grows, grow yield in nitrogen addition plots. The varieties Ursita and Alex were noted that had very high yields in both fertilization variants. About 29% of yield variability at $N_{100}P_{40}$ is associated with yield at N_0P_0. And here, as the latter grows, grows yield in the variant with the higher dose of nitrogen. The varieties Unitar, Alex and Ursita were noted, which had very high yields in both variants (unfertilized and $N_{100}P_{40}$).

The test weight is more influenced by the interaction variety x fertilization level than unique contribution of nitrogen

The 1000 grains weight is not influenced by the fertilization level but is influenced by the variety because it is a genetic impregnated character.

All varieties, without exception, registered a statistically assured increase in protein when the nitrogen dose was increased to N_{100}. The obtained results suggest that the high quantity of nitrogen influences the protein content, with increases between 0.7-1.5%. The correlation between the protein content obtained in the unfertilized variant and the protein content when fertilized with $N_{40}P_{40}$ is extremely strong (r = 0.912). For the studied interval, the coefficient of determination suggests that approximately 83% of the variability of the protein content to $N_{40}P_{40}$ is associated with the protein content from the unfertilized variant. Also, the correlation between the protein content obtained in the unfertilized variant and the protein content when fertilized with $N_{100}P_{40}$ is positive and extremely strong (r = 0.877). Approximately 77% of the variability of the protein content at $N_{100}P_{40}$ is associated with the protein content in the unfertilized variant.

The obtained results show that during the three years of experimentation, the quality of baking reflected through the sedimentation index was very good and the presence of nitrogen in high dose brings very significant increases of this indicator (+4 ml at $N_{40}P_{40}$ and 10 ml at $N_{10}P_{40}$).

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