THE INFLUENCE OF THE CLIMATIC CONDITIONS AND OF THE NITROGEN AND PHOSPHORUS FERTILIZERS UPON THE BAKERY QUALITIES OF THE WINTER WHEAT

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In a 5 years experience made on aluvisol soil in the Garvan locality in Tulcea district wich regarding the effect of the climatic conditions and the fertilizers with N and P upon the contain of wet and dry gluten at the variety of winter wheat dropia it had been detected that the Nitrogen had positively influenced the contain of wet and dry gluten. This had determined the increase of the content of dry gluten from 25.8 % in the N_0 variant , until 32.1% in the N_{160} variant and concerning the contain of wet gluten, this had increased from 7.4% until 9.2% at the same doses of fertilizers in a year wich was warmly and droughty at the begining of the spring. In the agricultural year 2004-2005, wich was much humid, the contain of dry gluten had reached the value of 27.9% and the contain of wet gluten was of 8,04 % in the N_0 variant comparing with N_{160} variant were the values were of 21.98% and 6.44%. It was observed o positive correlation between the contain of the wet gluten and the N dose of fertilise. The correlation between the P dose and the contain of dry gluten was distinct significant in a warmly and droughty year(2003) and insignifinact in a year with more humudity (2005).

***Key words**: fertilizer, dry gluten, wet gluten*

The most researches made in the last decades were made upon the nutrition qualities of the wheat seed regarding especially their protein content, the chemical content and the possibilities of improvement of these indices and the factors that give their values (Aydin, N. şi colab. 2005, Waga, J., 2001 Igrejas, G. şi colab. 2001 Dvoracek, V. şi colab. 2005 Kleijer, G. şi colab., 2007).

In our country the concern regarding the continuous growth of the production qualities at the wheat were and are made especially by the researchers than by the productions which consider that the "Romanian cereals" from some areas of the country are having a high quality.

The time had demonstrated that this is not true because the quality depends by a lot of parameters and these parameters had suffered a lot of changes. In an

another way, the quality appreciation and the production graduation must be made by depending of some indices and parameters that had became is numerous and their level imposed by the standard level ISO is higher.

Numerous researches made in different steps had distinguished the influence of the wheat variety, the climatic conditions and the fertilization, especially the nitrogen and the phosphorous fertilizers regarding the bakery qualities (Bădiceanu Lucia, 2004, Găvrus C., 2004; Gheorghiţă Şt., 2000, Tabără V. şi Puşcă I., 2003; Hera Cr., 1986, Negrilă Maria, 2005).

MATERIAL AND METHOD

The researches were made at SA Soimu SRL from the Vacareni Plain, Tulcea district in the Garvan locality, an a aluvisoil with pH 7,9 (on the 0-17 layer), 0.23% total nitrogen, 24.6 ppm mobile phosphorus and 240 mobile potassium, the raport C:N of 11.7.

From the five years of experiments, in two years of experiments the registered temperatures in the December month were - 4,4 ˚C (2001-2002) and - 5˚C (2002-2003), and in three years the temperature was positive in December. In all the researches years the precipitations were over the multiannual average. In the year 2002-2003 in spring the temperature were higher and the precipitations under the multiannual average the year being considered less favourable.

The experience was:

The A factor + phosphorus fertilization with five graduations: a_1 - P_0 , a_2 -P_{40}, a_3 - P_{80}, a_4 - P_{120}, a_5 - P_{160} .

The B factor- nitrogen fertilization with five graduations b_1- N_0, b_2- N_{40}, b_3- N_{80} $(_{40+40})$, b_4- N_{120} $(_{40+40+40})$, b_5- N_{160} $(_{40+80+40})$.

The phosphorus was applied under the basic plough, and the nitrogen at the preparation of the germination bed, at the beginning of the spring in the bladder faze.

In the present paper are the obtained results through the N, P and the interaction of the two elements fertilization, watching some qualities elements at the winter wheat which regard the bakery processes (wet and dry gluten). The researches were made on two years, one less favorable fro the winter wheat (2003) because of the higher temperatures and the less precipitations at the beginning of the spring and the other one very favorable.

RESULTS AND DISCUSSIONS

Results regarding the influence of the climatc conditions and N and P fertilizers upon the bakery qualities

From the bakery qualities, the content of wet gluten and dry gluten is the most important, it gives information upon the behavior in the process of the wheat flour industrializations and upon the nutritional value.

We present the obtained results through the determinations of gluten content in the two extremely years regarding the climatic conditions (2003 and 2005) and in the average of those two years.

The N fertilizers applied in doses from N_{40} to N_{160} had generally an favorable effect upon the gluten content, but different depending by the dose and the climatic year (*table 1*). Their effect were more pronounced in the 2005 year

(very wet) then the 2003 year, activating also in the way of the decreasing of the differences between the two years under the aspect of gluten content.

Without N the wet gluten content was 25.8 % in 2003 (good) and 21.98 (unsatisfying) in 2005, but the content of dry gluten was of 7.4 and 6.44%.

In the 2003 year, starting with the dose of N_{40}, it becomed very good, the increase being only with 1.1 percentage points and in the year 2005 was satisfying but it grew up with 1.88 percentage points distinct significant (at N_{40}).

In the 2003 year through the increase of the N dose, it raised with 2.8-6.3 percentage points reaching at 32.1 % at N_{160} and 9.2 dry gluten (with 24.3% bigger than at $N_{0)}$.

In the year 2005, the N_{80} and N_{120} doses had bigger effects then in the year 2003, increasing with 4.08 and 5.9 percentage points the content of wet gluten which reached very good values (27.88 %, at N_{120}, with 26.8 % bigger than N_0), but the content of dry gluten hade grew less in this year at the N doses mentioned.

Table 1

The influence of the nitrogen dose on humid and dry gluten content, in two years with extreme climate conditions (2003 and 2005)

The N dose kg/ha a.s.	The droughty year 2003				The rainy year – 2005				The average on the two years %	% than N_0	The difference between the two years
	% of gluten	% than the c.v. N_0	The difference than c.v. N_0	Signi-ficance	% of gluten	% than the c.v. N_0	The difference than c.v. N_0	Signi-ficance			
a.The wet gluten content (%)											
N_0	25.8	100.0			21.98	100			23.90	100.0	3.82
N_{40}	26.9	104.3	1.1		23.86	108.5	1.88	**	25.30	105.8	3.04
N_{80}	28.6	110.8	2.8	*	26.06	118.6	4.08	***	27.30	114.2	2.54
N_{120}	30.4	117.8	4.6	***	27.88	126.8	5.90	***	29.14	122.0	2.52
N_{160}	32.1	124.4	6.3	***	27.90	126.9	6.10	***	30.00	125.5	2.10
DL 5 %			0.89 %				1.12 %				
DL 1 %			1.37 %				1.72 %				
DL 0.1 %			2.08 %				2.62 %				
b. The dry gluten content (%)											
N_0	7.4	100.0	-		6.44	100.00			6.92	100.0	0.96
N_{40}	7.7	104.0	0.3		7.22	112.11	0.78	*	7.46	107.8	0.48
N_{80}	8.2	110.8	0.8	**	7.32	113.70	0.88	**	7.76	12.5	0.88
N_{120}	8.9	120.3	1.5	***	7.66	118.90	1.22	**	8.28	119.8	1.34
N_{160}	9.2	124.3	1.8	***	8.04	124.80	1.60	***	8.62	124.6	1.16
DL 5 %			0.48 %				0.56 %				
DL 1 %			0.74 %				0.87 %				
DL 0.1 %			1.12 %				1.34 %				

The dose of N_{160} had the same effect the N_{120} in 2005, smaller than in 2003, only at the dry gluten having the same effect as in 2003 and bigger than at the dose N_{120} very significant.

The correlation between the gluten content and the N dose was distinct significant in 2003 (*fig. 1*) and only significant in 2005 (*fig. 2*).

The average of the two years, without the N, the gluten content was satisfying, with a dose of N_{40} was good and with bigger N doses it became very good with a raise of almost 2 percentage points at every growth of the dose and

smaller with 1 percentage point at the dose of N_{160} than N_{120}, the maximum growth being of 3082 percentage points. The differences between the two years of 3.82 percentage points at the unfertilized variant had decreased until 2.1 percentage points in the maximum dose of N_{160} and this succeeded to attenuate with 1.72 percentage points than the unfertilized.

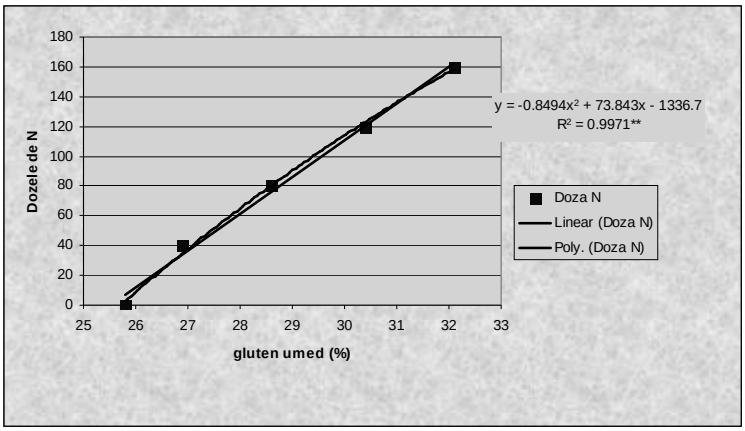

Figure 1 **Correlation between the humid gluten content (%) and the nitrogen dose in 2003**

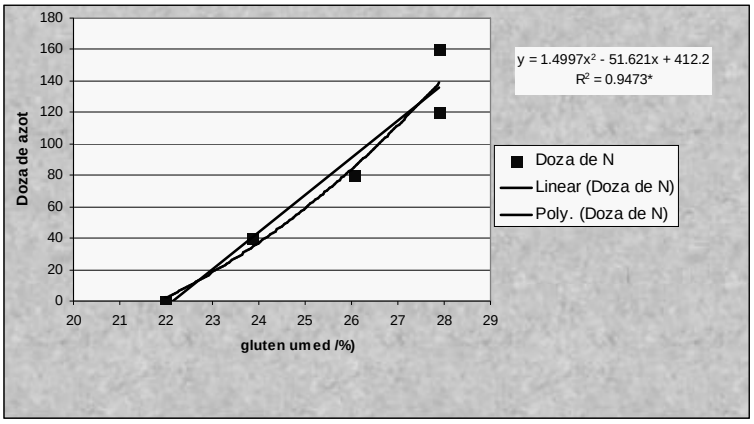

Figure 2 **Correlation between the humid gluten content (%) and the nitrogen dose in 2005**

The content of dry gluten had also grew with the N dose, less tah the wet gluten and the differences between the two extremely years were attenuated by the small N doses.

The phosphorus fertilizers had smaller effect than those with N upon the gluten content, effects which had depended of the interaction of each dose with the climatic year (*table 2*). The correlation between the phosphorus dose and the wet gluten content was only in the year 2003 distinct significant (*fig. 3*), and in 2005 unsignificant.

On the average all the nitrogen doses were strong felt in the year 2005 and less felt in the year with high temperatures.

In the 2003 year only the P_{80} and P_{120} doses had positive significant effects, the dose of P_{160} leading a distinct significant decrease of the gluten contain and insignificant at the dry gluten content.

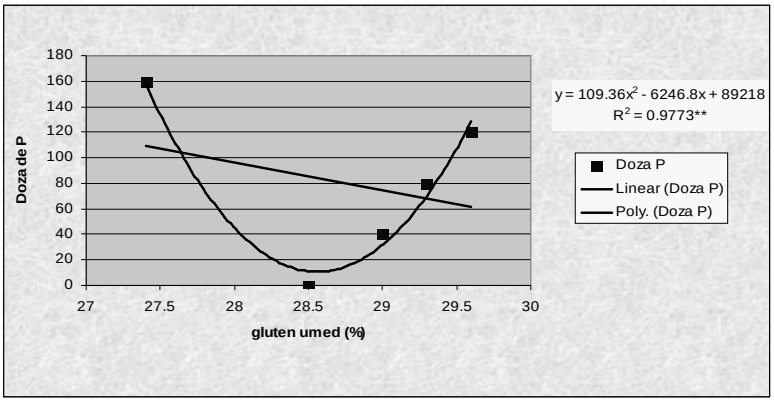

Figure 3 **Correlation between the humid gluten content (%) and the phosphorus dose in 2003**

Table 2

The influence of the phosphorus dose on wheat's humid and dry gluten content, in two years with extreme climate conditions (2003 and 2005)

The P dose kg/ha a.s.	The droughty year 2003				The rainy year – 2005				The average on the two years %	% than N_0	The difference between the two years
	% of gluten	% than the c.v. P_0	The difference than c.v. P_0	Signi-ficance	% of gluten	% than the c.v. P_0	The difference than c.v. P_0	Signi-ficance			
a. The wet gluten content (%)											
P_0	28.5	100.0			24.4	100.0			26.45	100.0	4.1
P_{40}	20.0	191.7	0.5		25.2	193.3	0.8	*	27.10	102.4	3.8
P_{80}	29.3	102.8	0.8	*	25.84	195.9	1.44	**	27.57	104.2	3.46
P_{120}	29.6	103.9	1.1	**	26.18	107.3	1.78	***	27.89	105.4	3.42
P_{160}	27.4	96.1	-1.1	00	26.06	106.8	1.66	**	26.73	101.0	1.34
DL 5 %			0.68 %				0.71 %				
DL 1 %			1.07 %				1.09 %				
DL 0.1 %			1.67 %				1.68 %				
b. The dry gluten content (%)											
P_0	8.1	100.0	-		6.64	100.0			7.37	100.0	1.46
P_{40}	8.5	104.9	0.4	*	7.26	109.3	0.62	*	7.88	196.9	1.24
P_{80}	8.4	103.7	0.3		7.42	111.7	0.78	*	7.71	104.6	0.98
P_{120}	8.5	104.9	0.4		7.94	119.6	1.30	**	8.22	111.5	0.56
P_{160}	7.8	96.3	-0.3	*	7.40	111.4	0.76	*	7.60	103.1	0.40
DL 5 %			0.32 %				0.61 %				
DL 1 %			0.49 %				1.00 %				
DL 0.1 %			0.75 %				1.52 %				

In the year 2005 the effects determined by the phosphorus were bigger than in 2003, but here the dose of P_{160} determined an smaller gluten percentage than the

P_{120} dose, but distinct significant bigger than at P_0. The effect upon the dry gluten content had the same direction, but smaller.

We notice than in 2003 without phosphorus at all the doses, the percentage of gluten was very good and in 2005 at doses of P_0, P_{40} and P_{80} was good, only at the doses of P_{120} and P_{160} being very good.

On an average on the two years the percentage of wet gluten was very good without P, the maximum value of 27.8 % being obtained at P_{120} dose almost equal with the one of P_{80} and even P_{40} and at the dose of P_{160} the percentage of wet and dry gluten had decreased being almost equal with P_0.

The maximum dose of P_{160} had reduced the annual fluctuations more then the other doses and the small and medium dose had a more reduced effect although their reaction was in the same direction.

The interactions between nitrogen and phosphorus had a more pronounced effect in the wet year 2005 than in 2003 year, so that annual fluctuations were strong influenced of this interaction watching the wet and dry gluten content.

The content of the wet gluten under the climatic year conditions an the interaction between of N and P is presented in table 3.

In the year 2003 the content of wet gluten, varying between 25.2 % and 33.5 %, except the combinations of N_0P_0, N_0P_{40} and N_0P_{160} was very good approaching of the limit of this grade only at the interaction of the N_{40} with P_{160}, and P_0. The differences were not statistical ensured, the P_{80} and P_{120} having a distinct significant influence. Like the N_0, the P_{160} dose had a negative effect, but smaller than the N_0 fund.

In the situation of N_{80} doses and bigger, the negative effect of the extreme dose of phosphorus increased in the same time with the increase of the nitrogen dose, but the interactions between this bigger doses of nitrogen with the others phosphorus dose had increased very significant the content of wet gluten. At the N_{120} dose the doses of P_{40} and P_{80} had increased the contain of wet gluten at values bigger than 30.8% with 604 percentage points at the $N_{120}P_{80}$, and increasing the dose at P_{120} had a negative effect but smaller than those of P_{160} dose.

When the dose of N_{160} was applied without phosphorus or only with P_{40} the content of wet gluten had reached the 33% value but also at the $N_{160}P_{120}$ dose had very high values. At the $N_{160}P_{160}$, he decreased until 29.2 %.

In this way it had been proved the good effect of the big N dose but combined with phosphorus dose of 40-120 kg/ha a.s. or without P or with a medium phosphorus dose combined with P_{120}, but also the negative effect of the P_{160} dose upon the wet gluten content.

The interaction which showed good results upon the content of wet gluten in the droughty year were: $N_{160}P_{40}$, $N_{160}P_{0,}$ $N_{160}P_{120}$, $N_{120}P_{80}$ and $N_{160}P_{80}$. In the conditions of Teleorman in a droughty year Maria Negrilă had obtained at an unfertilized variant 24.1% wet gluten, at the variant $N_{120}P_{80}$ - 30.3 % an at the variant $N_{160}P_{160}$ – 32 % here the P_{160} dose combined with the N_{160} dose having a negative effect. Maria Ştefănescu (1994) had obtained at the same variety and at the interaction of $N_{100}P_{90}$ in a droughty year a bigger wet gluten content of 35%. In

this conditions of droughty the accumulation of C hydrates is happening in a small period and the report is changing in the favour of protein substances.

At the same variety, Dropia but in the S Plain and Dobrogea, N.Ştefan (2005) mention values of 35.68% gluten content on a fund of $N_{120}P_{90}$ for the favorable year 2004 in the production conditions with values more 32% were obtained, and with $N_{100}P_{90}$ but only in a droughty year, while in the rainy year the maximum percentage of wet gluten was only of 22% at $N_{150}P_{90}$, *(Gheorghiţă, S. -2006).*

Table 3

The influence of the nitrogen and phosphorus doses' interaction on wheat's humid gluten content, in two years with extreme climate conditions (2003 and 2005)

The N dose kg/ha a.s.	The P dose kg/ha a.s.	The droughty year 2003				The wet year – 2005				The average on the two years	The difference between the 2003 and2005
		% of wet gluten	% than v.c. N_0P_0 %	The difference than v.c. N_0P_0 %	Signi-ficance	% of wet gluten	% than v.c. N_0P_0	The difference than v.c. N_0P_0 %	Signi-ficance		
N_0	P_0	25.8	100.0	-		20.9	100.0	-		23.35	4.9
	P_{40}	25.2	97.7	-0.6		21.6	103.3	0.7		23.40	3.6
	P_{80}	26.5	102.7	0.6		21.9	104.8	1.0	*	24.20	4.6
	P_{120}	26.6	103.1	0.8		22.3	106.7	1.4	*	24.45	4.3
	P_{160}	25.0	96.9	-0.8		23.2	110.5	1.3	*	24.10	2.8
N_{40}	P_0	26.3	101.9	0.5		22.8	109.1	1.9	**	24.95	3.5
	P_{40}	26.8	103.9	1.0	*	23.6	112.9	2.7	***	25.20	3.2
	P_{80}	27.3	105.8	1.5	**	23.9	114.3	3.0	***	25.60	3.4
	P_{120}	27.8	107.7	2.0	**	24.3	116.3	3.4	***	26.05	3.5
	P_{160}	26.1	101.2	0.3		24.7	118.2	3.8	***	25.40	1.4
N_{80}	P_0	28.4	110.1	2.6	***	24.8	118.7	3.9	***	26.60	3.6
	P_{40}	28.9	112.0	3.1	***	25.6	122.5	4.7	***	27.25	3.3
	P_{80}	28.8	111.6	3.0	***	25.9	123.9	5.0	***	27.35	2.9
	P_{120}	29.3	113.6	3.5	***	26.8	128.2	5.9	***	28.05	2.5
	P_{160}	27.8	107.7	2.0	***	27.2	130. 1	6.3	***	27.50	0.6
N_{120}	P_0	28.9	112.0	3.1	***	26.1	124.8	5.2	***	27.50	2.8
	P_{40}	30.8	119.4	5.0	***	27.4	131.1	6.5	***	29.10	3.4
	P_{80}	32.2	124.8	6.4	***	28.9	138.3	8.0	***	30.55	3.2
	P_{120}	31.3	121.3	5.5	***	29.3	140.2	8.4	***	30.30	2.0
	P_{160}	28.9	112.0	3.1	***	27.7	132.5	6.8	***	28.30	1.1
N_{160}	P_0	33.0	127.9	7.2	***	27.4	131.1	6.5	***	30.35	6.6
	P_{40}	33.5	129.8	7.7	***	27.8	133.0	6.9	***	30.65	5.7
	P_{80}	31.9	123.6	6.1	***	28.6	136.8	7.7	***	30.25	3.3
	P_{120}	32.8	127.1	7.0	***	28.2	134.9	7.3	***	30.50	4.6
	P_{160}	29.2	113.2	3.4	***	27.5	131.5	6.6	***	28.35	1.7
DL 5 %				0.89 %				0.96 %			
DL 1 %				1.37 %				1.48 %			
DL 0.1 %				2.08 %				2.25 %			

In the droughty year the gluten content was positive correlate with the protein content, the value being distinct significant (*fig. 4*), than HW were the value is only significant (0.72 comparated with 0.51), (*fig. 5*).

In the year 2005, the most rainy year the gluten content had values from la 20.9% ($N_0P_{0)}$ at 29.3% ($N_{120}P_{120}$), the interaction of NP doses with a stronger effect than in 2003 inducing a departure between the extreme 8.4 percentage point than 7.7 in the 2003 year. Aso in this case the nitrogen dose had in the interaction bigger

contribution then the P dose, and the P dose had an negative behavior in the interaction with N doses. Without N at N_{40} and N_{80} the P_{160} dose had increased the wet gluten content, but its effect had decreased at the raise of the N dose.

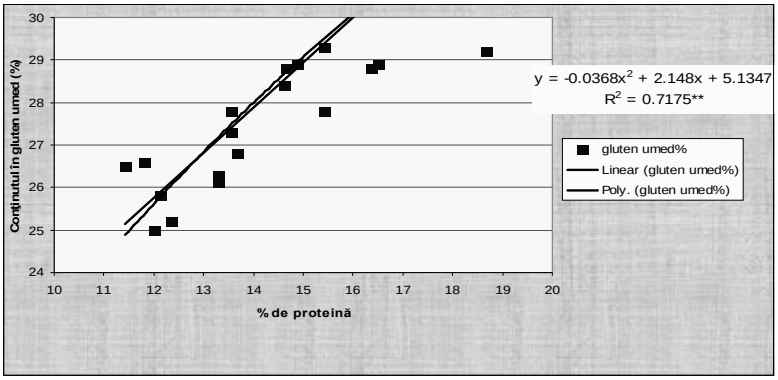

Figure 4 **Correlation between the humid gluten content (%) and the protein content in 2003**

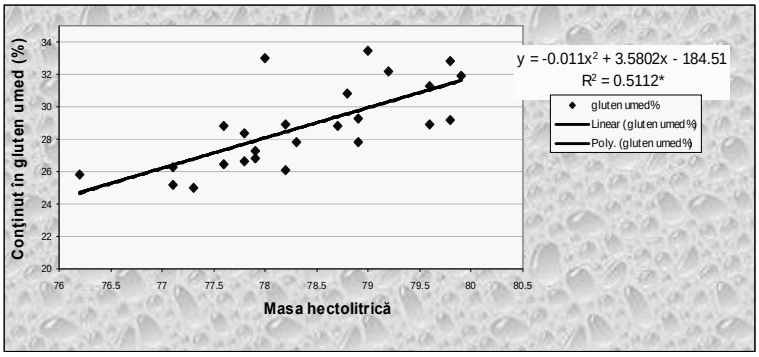

Figure 5 **Correlation between the humid gluten content (%) and the hectoliter mass (HW) in 2003**

Without N at N_{40} and N_{80} the gluten content in this year was unsatisfying (under 22%) and the differences toward the 2003 year had values of 3.6 and 4.9 percentage points and on the average of the two years was satisfying.

Although sometimes they bring significant spores the variants N_0P_{120}, N_0P_{160}, $N_{40}P_0$, $N_{40}P_{40}$ and $N_{40}P_{80}$ didn't surpass the gluten content of 24% receiving the satisfying grade, they had with 3.2 -3.5 percentage points less than 2003 so on an average on the two years are not good, but satisfying like the $N_{40}P_{160}$ or $N_{40}P_{120}$ variants.

On an fund of N_{80} the wet gluten content increased becoming good, at the interaction with P_0, P_{40}, and P_{80} the departure toward the 2003 year being only of 3.6 -2.9 percentage points so the two years average becomes good (bigger than 26%).

At all the others interactions, starting with $N_{80}P_{120}$, the wet gluten content was very good, increasing with the growth of the N dose until N_{120} and with the

increase of the P dose until P_{80} or P_{120}, at P_{160} even P_{120} (on a fund N_{160}), but he decreased. On the average on the two years, the maximum values (30.65 and 30.55%) were recorded at $N_{160}P_{40}$ in the droughty year and $N_{120}P_{80}$ in 2005 when it was situated onteh second place. In the 2005 year on the first 5 places were: $N_{120}P_{120}$, $N_{120}P_{80}$, $N_{160}P_{80}$, $N_{160}P_{120}$, $N_{160}P_{40}$.

Very high values in the both years with reduced fluctuations between the extreme values had performed the combinations $N_{120}P_{120}$ (31.3 – 20.3 % - departure of 2 percentage points), $N_{120}P_{80}$ (32.2 – 28.9 % - departure, 3.2 percentage points), $N_{160}P_{80}$ (31.9 – 28.6 % - departure of 3.3 percentage points).

At some combinations, the medium performances were very good, but the differences between the two years were considerable smaller than $N_{160}P_{40}$ – a difference of 5.7 percentage points, < $N_{160}P_0$ - difference of 6 percentage points; $N_{160}P_{120}$ – difference of 4.5 percentage points, but with an average of 30.5% situated on the 3 place.

We see that at the P_{160} dose even if it hadn't had so many performances like the P_{120} dose it contributed at the reducing of the distance between the two years. In the year 2005 the gluten content was positive correlate and very significant with the protein content, with HW, the correlations indices having bigger values than in 2003 (*fig. 6 and 7*).

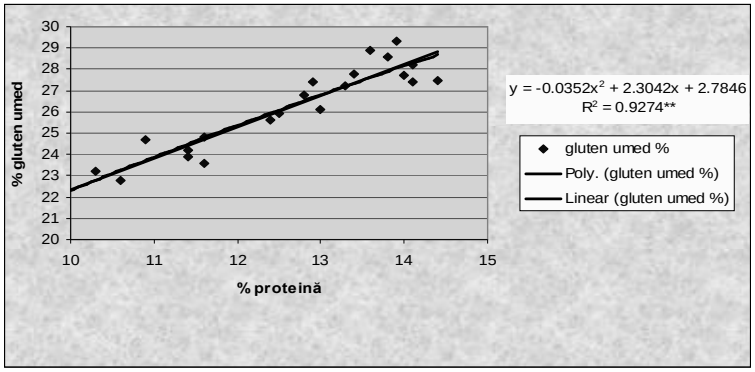

Figure 6 **Correlation between the humid gluten content (%) and the protein content in 2005**

On a average of the two years at the interaction of the N and P doses, the gluten content is in a positive correlation and very significant with MH with a bigger indices then the two years watched separate (*fig. 8*) which show the relevance which can have this physical indices in the graduation of wheat quality.

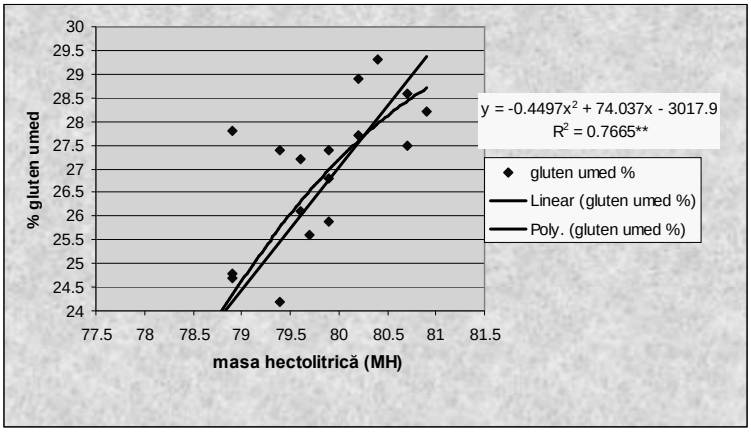

Figure 7 **Correlation between the humid gluten content (%) and the hectoliter mass (HW) in 2005**

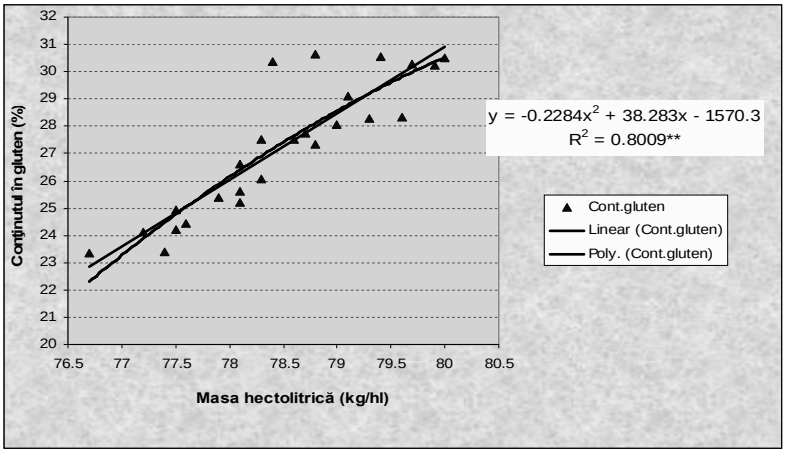

Figure 8 **Correlation between the hectoliter mass (kg/hl) and the humid gluten content (%) forthe nitrogen and phosphorus doses' interaction (average value for 2003-2005)**

CONCLUSIONS

The bakery qualities of the wheat are depending by the protein content of the caryopsis which correlated positive and very significant with the wet and dry gluten content also in the droughty years as in the wet years and depending also by the HW af the wheat which correlated significant in a wet year, significant in the droughty year and distinct significant in the average.

The wet gluten content had depended by the climatic conditions of the year in the 2003 droughty in the spring having higher values in than in 2005 wet year.

The nitrogen fertilizers applied in dose until 160 kg/ha had increased the wet gluten content with 32.1% in the droughty year and with 27.9% in the wet year.

The applied P fertilizers had influenced in a reduce way he content of wet gluten than the N.

The combination $N_{120}P_{120}$ was favorable under the all ways: the content of dry and wet gluten was very high in the both years, so stabile; For the backer process is important only the most high content of wet gluten, but stabile because the wet gluten is reflecting also the proteins quality from the gluten their ability of good hidratation during in processing the dough.

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