RESEARCH REGARDING THE UNBALANCED NUTRITION APPEARCE IN LONG TERM FIELD EXPERIMENTS WITH CHEMICAL FERTILIZERS

CERCETĂRI PRIVIND APARIȚIA DEZECHILIBRELOR DE NUTRIȚIE ÎN EXPERIENȚELE DE LUNGĂ DURATĂ CU ÎNGRĂȘĂMINTE CHIMICE

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Abstract: *The paper presents the effect unbalanced nutrition because of long term chemical fertilization application. Nitrogen fertilizers application in different phosphorus backgrounds influenced differentiate the pH and mobile aluminum soil content values, chemical indexes with large effect on plant nutrients availability. The nitrogen and phosphorus fertilizers application determined progressive decreasing of pH values and increasing of mobile aluminum content in preluvosoils conditions. The pH-values after 30 years by nitrogen application decreased from 6.27 to 5.36 on unfertilized phosphorus background and from 6.03 to 4.98 in the case of P_{160} phosphorus background fertilized. The mobile aluminum soil content because of long term nitrogen application increased with values ranged between 1.5 and 6.07 mg/100g soil in function of phosphorus background utilized. The data presented show that the pH and the mobile aluminum soil content is also depending on the mobile phosphorus soil content because the higher level of phosphorus determine bigger yields respective bigger nutrients consumption with cause soil debasification.*

Rezumat *Lucrarea prezintă efectul apariției dezechilibrelor de nutriție ca urmare a fertilizării îndelungate cu îngrășăminte chimice. Aplicarea îngrășămintelor cu N în diferite doze pe agrofonduri de fosfor influențează diferențiat valorile pH şi ale conținutului în aluminiu mobil al solului, indicatori chimici care influențează accesibilitatea pentru plante a altor macro şi microelemente. Valorile pH-ului, după 30 de ani de aplicare în staționar a azotului scade de la 6,27 la 5,36 pe agrofondul nefertilizat cu fosfor şi de la 6,03 la 4,98 în cazul agrofondului fertilizat cu P_{160}. Conținutul solului în aluminiu mobil în urma aplicării îndelungate a îngrășămintelor cu N creşte cu valori cuprinse între 1,5 – 6,7 mg/100g sol în funcție de agrofondul de fosfor utilizat. Datorită creşterii acidității şi valorilor conținutului de Al mobil din sol, producția de grâu se plafonează şi chiar scade. Valorile conținutului de Al mobil din sol care influențează negativ producția sunt diferite în funcție de agrofondul de P utilizat. Se impune ca pe aceste soluri să fie permanent urmărite valorile pH şi conținutul în Al mobil pentru a se interveni cu amendamente care să prevină apariția dezechilibrelor de nutriție.*

Key words: *unbalanced nutrition, mobile aluminum, pH, nitric phytotoxicity, yield level*
Cuvinte cheie: *dezechilibre de nutriție, Aluminiu mobil, pH, fitotoxicitate nitrică, nivel de producție*

INTRODUCTION

The inadequate fertilization regarding soil conditions and plant needs, can cause severe nutritional unbalances, manifested through the apparition of some characteristic plant phenotype symptoms which at the end lead to a significant regression of production and quality.

The correct and efficient appliance of fertilizers with nitrogen supposes the cognition of soil's features and of the demands of the cultures in nitrogen, contrarily reaching some serious unbalanced nutrition.

The coefficient of using the nitrogen from the chemical fertilizers with nitrogen in the whole period of vegetation of yearly plants is comprised between 40-80 %, currently 50-60 %.(CIOBANU 2004, HERA 2007, JAKAB LOCH, JÁNOS LAZÁNY ET AL, 2007)

The secondary acidifying and increasing mobile aluminium content of the soil as a result of the appliance of fertilizers with nitrogen, influence negative the plant's growth and development because of nitrogen rates applied, higher than the plants needs.

The incidental appearance of the nutrition unbalanced depends on one hand of the chemical, physical and biological properties of the soil which determines its relative stability and on the other hand of the fertilizers doses and the ratios between the used fertilized elements.

The mobile aluminium excessively found in soil has a mechanical action of destroying the absorptive parts on the plant's roots, which have a decisive role in cations and anions selective assumption from soil's solution, depending on physiological needs of the plants (W. J. SLATTERY, G. R. ROUNDFELDT, 1992).

The researches demonstrated that the destruction of the roots creates favourable conditions for the unselective entrance in plant of the nutritive elements, not depending on the plant's needs but direct correlated with their concentration in soil's solution (J. HORST ET AL, 2002).

MATERIAL AND METHOD

Experimental site

The research data was obtained at the Agricultural and Development Research Station Oradea, using a unique design in the all research network of Research Institute from Fundulea.

The investigation has been carried out beginning with the autumn of 1974 in Oradea, in a flat plane area on the third terrace of the Crisul Repede river, whose geographical coordinates are: $21^{o}56^{'}$ Eastern longitude, $47^{o}03^{'}$ Northern latitude and 136 m altitude.

The solidification rock consists of clay loam. The ground water is located at a depth of 6-8 m, the soil is a preluvosoil one with horizon disposition and the main physical and chemical characteristics are shown in table 1. The presence of clay migration, B horizon is to be remarked noticed on the thickness of the soil profile, with high and very high values of the bulk density and compaction level and low or very low total porosity and hydraulic conductivity.

The soil reaction is acid in the ploughing A horizon, then slightly acid. The lack of $CaCo_3$ in the soil profile is underlined. The mobile Al content in the A horizon may cause poor growth of some crops (clover). The soil is well provided with mobile potassium and phosphorus. The soil humus medium content may not cause distortion to the neutronic determination of the soil moisture.

The factors researched N are the nitrogen and phosphorus fertilizers application:

a. phosphorus rates: P_0, P_{40}, P_{80}, P_{120}, P_{160} like superphosphate, applied in autumn
b. nitrogen rates: N_0, N_{40}, N_{80}, N_{120}, N_{160} applied like ammonium nitrate in two phases (1/2 rate in autumn and 1/2 rate in spring).

The methods utilized in laboratory analysis was those utilized in the network of ICCPT Fundulea

Table 1

The main properties of the preluvosoil from Oradea – Romania

Soil depth cm	Sand	Silt	Clay	OC	Humus %	$CaCO_3$ %	Al mobile mg/100g soil	PH 1:2 H_2O	N Total %	P mobile ppm	K mobile ppm
0-5	43.5	28.3	28.2	1.25	2.32	0.00	3.68	6.3	0.12	21.8	83.0
5-15	41.8	28.4	29.8	1.12	2.28	0.00	2.32	6.4	0.11	22.7	102.1
15-30	40.0	28.5	31.5	1.02	1.91	0.00	0.52	6.3	0.09	5.7	112.1
30-60	32.0	28.0	40.0	0.99	1.93	0.00	0.77	6.6	0.09	6.1	117.9
60-90	24.1	36.7	39.2	0.29		0.00	0.32	6.6			
90-150	35.1	27.3	37.6	0.17		0.00	0.59	6.5			

RESULTS AND DISCUSSIONS

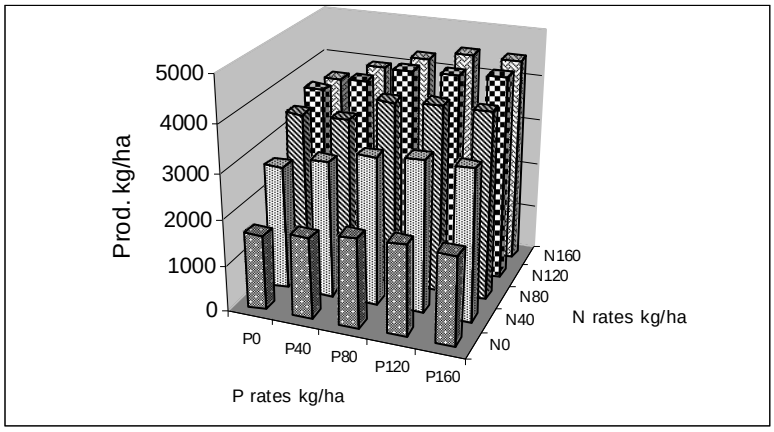
Long term nitrogen fertilizers application on different phosphorus backgrounds influenced in different way the yield level in function of applied rates.

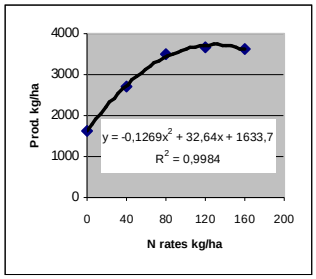
Analyzing the research presented data in figure 1 is remarked that the highest yield spores are obtained in the case of the middle and low rates in all the five phosphorus backgrounds utilized.

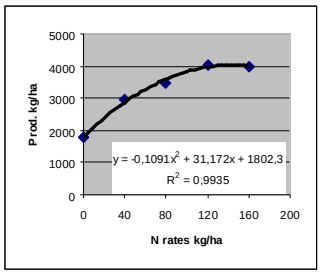
Increasing the nitrogen rate from 80 kg N/ha to 120kg N/ha is realized lowest yield spores or even diminishing of yield.

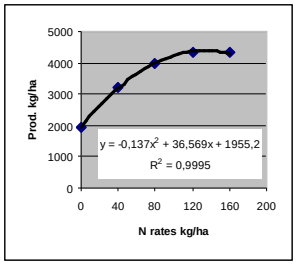
The observations from vegetation period show that the diminishing of yield appears mainly because of phytotoxicity phenomenon in first vegetation fazes which appear in the cold springs in the variants fertilized with high nitrogen rates.

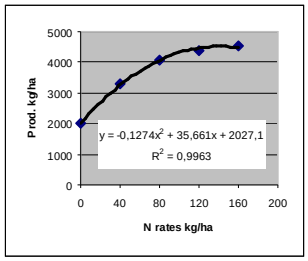
Between the factors which determine appearance of phytotoxicity phenomenon are in the same time the increasing of mobile aluminium soil content because of secondary acidification because of high nitrogen rates applied.











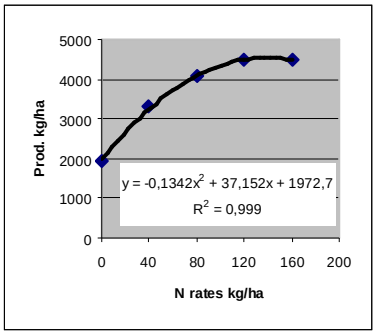


Figure 1. Influence of nitrogen rates applied in different phosphorus backgrounds on yield level of wheat in preluvosoil conditions from North Western from Romania

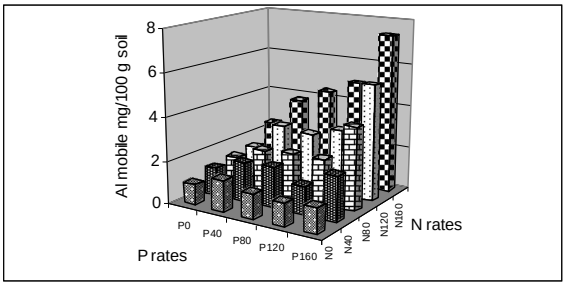
In figure 2 is presented the influence of nitrogen rates applied in different phosphorus backgrounds on soil reaction.

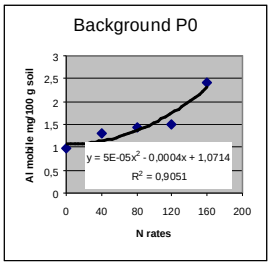
It is remarked that the soil reaction is negative influenced by the big nitrogen and phosphorus rates. That phenomenon justified the decreasing of yield level in the case of bigger fertilizers rates applied.

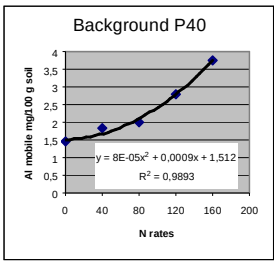
In figure 2 is presented the influence of nitrogen rates applied in different phosphorus background on mobile aluminium soil content.

The data presented show that between the nitrogen rates and the mobile aluminium soil content level there are a much closed positive correlation – the higher N rates determining higher mobile aluminium soil content.

The values of mobile aluminium soil content are depending in the same time by the phosphorus background utilized because that in the case of high phosphorus rates applied will determine more accentuate soil debazification, respectively increasing soil acidity and implicit increasing of mobile aluminium soil content.







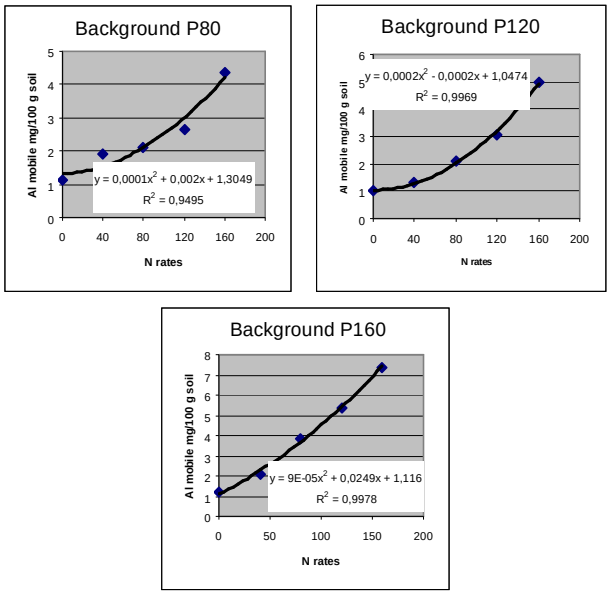


Figure 2. Influence of nitrogen rates applied in different phosphorus backgrounds on mobile aluminium content in preluvosoil conditions from North Western from Romania

In figure 3 is presented the results regarding correlations between mobile aluminium soil content and the wheat yield level obtained.

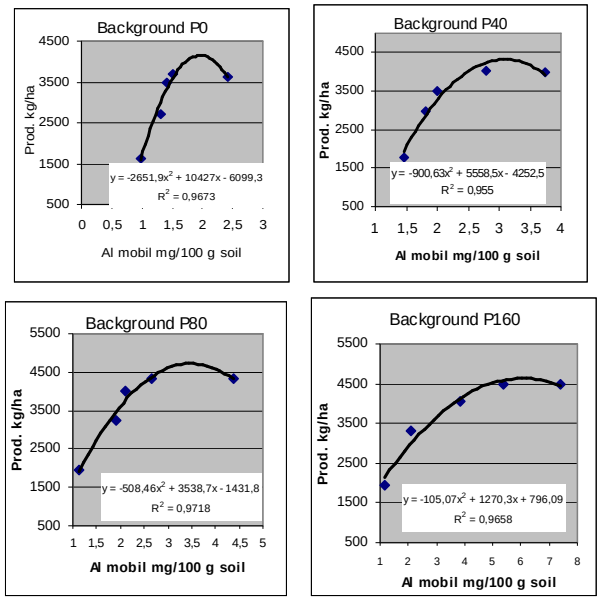


Figure 3. Influence of mobile aluminium content on wheat yield level in preluvosoil conditions from North Western from Romania

It is obvious that in the case of high level of mobile aluminium soil content the wheat yield is negative affected.

The research obtained in long term field experiments from Oradea arrives at conclusions that the bigger negative influence on yield level has the increasing of the mobile Al soil content because of higher nitrogen and phosphorus rates applied than the plants needs.

In the preluvosoil conditions is very important to use rational fertilizers rates and periodic, at least, from six to six years is necessary to apply limes for rebazification of the soil.

CONCLUSIONS

Long term chemical fertilizer application in preluvosoil conditions can cause severe nutritional unbalances, manifested through the apparition of some characteristic plant phenotype symptoms with at he end lead to a significant regression of quantity and quality yield.

The research obtained in long term yield experiments from Oradea in preluvosoil conditions arrives at the conditions that the bigger influence on yield level has the increasing of the mobile Al soil content because of nitrogen and phosphorus applied in higher rates than the plants needs.

In the preluvosoil conditions is very important to use rational fertilizers rates and periodic at least from six to six years is necessary to apply limes for increasing pH-values and rebazification of the soil.

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