RESEARCH CONCERNING THE AGROCHEMICAL OPTIMIZATION OF THE FERTILIZATION SYSTEM FOR WHEAT CROPS ON AN ARGIC PHAEOZEM SOIL IN THE TRANSYLVANIAN PLAIN

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Abstract: *The current research is based on the production results obtained on wheat crops in long term experiments conducted on an argyle phaeozem soil at SCA Turda. The goal of this research is to scientifically, agrochemically and economically substantiate the differentiated fertilization systems involved in obtaining big productions in the reference area. In this study we tried to track the effect of the nitrogen-potassium interaction in achieving the productions obtained in 2012. The research presents the stated results as annual (partial) values and it will continue with them as being reference values for further experimental years (as stages in long term experiments) and obviously with approaches that will economically substantiate the suggested solutions. The production data are obtained from these experiments, framed in the "long term experiments system" from ASAS-ICDCPT Fundulea network which hold objectives that target both the effect and efficiency of differentiated fertilizations on productions and also the impact of fertilizers on the soil fertility evolution, on the quality of the productions obtained.The degree of novelty of this study can be expressed through the fact that for the type of soil and genotypes used in the experiments we can establish fertilization solutions and synthesized mathematical models with a high dissemination and applicability value in similar ecologic conditions. The obtained results present the production levels obtained for wheat crops (Dumbrava kind) at two alternatives for prior crops-corn and soy-statistically processed using variance and quadratic regression, as useful models for fertilization in the fertilization systems that were researched. It is obvious that at the end of these annual research the presented models will include the same objectives as in the prior years that were studied. The already existing and further research will enrich the study's utility in taking a rational fertilization decision based in the future also on the support of the suggested solutions through economically efficiency calculations of these solutions. The presented data hold originality, according to which the suggested solutions through fertilization models become important and present a real efficiency in the fertilization practice and technologies applied to wheat crops.*

Key words**:** *productions, wheat crops, nitrogen-potassium interaction, experimantal years, fertilization systems*

INTRODUCTION:

The current study represents an important part, together with the annual partial results, in the proposed research for developing the PhD thesis "The economical optimization regarding the fertilizing system for wheat and corn in the Transylvanian Plain". The approach of problems concerning the economical optimization for fertilizing systems, required as a previous phase, the study of agrochemical optimization of the fertilizing systems based on the complex application of NP fertilizers for wheat crops in 2011. The presented results and their interpretation are based on other pervious contributions in the sphere of crop rational fertilization achieved in several ecological, pedological, agro-chemical conditions in Romania. (Borlan, Hera et al.,1994; Hera, 1996). Our contribution, emphasized through current results, certifies the effect of the NP interaction in achieving high productions and practical

dissemination possibilities of the nitrogen interaction, which becomes an essential element by sustaining the phosphorus fertilizing interventions.

These results, besides the ecological, pedological, agrochemical conditions in which the experiments were conducted can also refer and generalize in technical conditions in which intervenes, as a variable, the previous cultivated plant before wheat crops (corn and soy).

MATERIAL AND METHODS

The production results that were capitalized and interpreted in this study were obtained from a long term experiment, since the agricultural year 1966-1967, located on an argic phaeozem from SCA Turda, which held the experimental factors unchanged over time.

The studied fertilization factors hold the next graduations:

- For wheat cultivated after corn: - a factor = N doses, kg/ha: 0, 40, 80, 120, 160
  - b factor = P doses, kg/ha: 0, 40, 80, 120, 160
- For wheat cultivated after soy: - a factor = N doses, kg/ha: 0, 30, 60, 90, 120
  - b factor = P doses, kg/ha: 0, 40, 80, 120, 160

Argic phaeozem from SCA Turda is a representative type of soil for the agricultural areas in Transylvania and it holds the next pedological and agrochemical attributes: (Table 1).

Table 1

Pedological and agrochemical attributes for argic phaeozem from SCA Turda

Physical and chemical analysis			
Horizon	Am	Bt	Cca
Depth (cm)	40-60	60-160	160-180
pH	5,24	5,51	6,80
Humus %	2,46	1,88	0,70
N-total	0,133	0,124	0,050
P ppm	278	120	10
K ppm	420	127	68
Ca me	10,2	10,7	18,2
Mg me	1,2	0,9	0,7
Granulometric analysis			
Coarse sand 2-0,22 mm	0,2	0,2	0,1
Fine sand 0,2-0,02 mm	16,2	14,0	19,8
Dust 0,02-0,002 mm	42,0	37,8	41,9
Clay 0,002 mm	41,6	48,0	38,2

According to the analyzed and presented data the soil holds in the superficial horizon and in the medium horizon a moderate acid reaction that had an acidification tendency over time due to unilateral mineral fertilizations without including in the fertilization technology of some organic fertilization sources. The soil holds, in the superficial, arable, processed horizon a medium towards low nitrogen content, a very good phosphorus supply, a very good towards an excessive potassium supply. From a physical point of view the soil exhibits a high level of clay (>40%) with a maximum accumulation of this clay in the intermediary horizon that has a clay illuvated character (Bt).

The good representation of the argillic minerals and the average representation of humus determine the individualization of an absorption complex well represented which may make the soil suitable for fertilization systems based on high nutritional elements doses. The

reduction in time of the organic carbon content recommends for maintaining the fertility of this soil and its productivity, some organic fertilization interventions, obviously as periodic interventions. In approaching the soil analysis we took into consideration the procedures and methods recommended and promoted in the soil scientific area by ICPA (ICPA 2011; Florea, Munteanu, 2012).

The processing and interpretation of the data was conducted using the production curves according to polynomial models and they were graphically represented in this study.

RESULTS AND DISCUSSIONS

The obtained results reveal that the argic phaeozem from SCA Turda holds a medium and good production potential for wheat, achieving multi-annually, in the control variants (unfertilized) productions of 2,2-2,8 t/ha for wheat cultivated after corn and of 3,0-3,9 t/ha for wheat cultivated following soy, here intervening the previous plant's contribution in the content of available nitrogen. In exchange, the complex NP application proved a significant efficiency for the two macro-elements' interaction, which determined maximum productions for wheat cultivated following corn at $N_{120}P_{80}$ fertilization variant (5,53 t/ha) and for wheat cultivated following soy also at $N_{120}P_{80}$ fertilization variant (5,50 t/ha).

The production potential of this type of soil is positively exploited through differentiated applications, as doses, but with a simultaneous complex nitrogen and phosphorus application, the productions and gains of these depend on the applied levels and the reports established between the fertilizing elements. Production data obtained in 2011 significantly states the productive value of the NP interaction, where nitrogen is the primary nutritional factor and phosphorus sustains through differentiated applications a better exploitation of the nitrogen effect (Figure 1 and Figure 2).

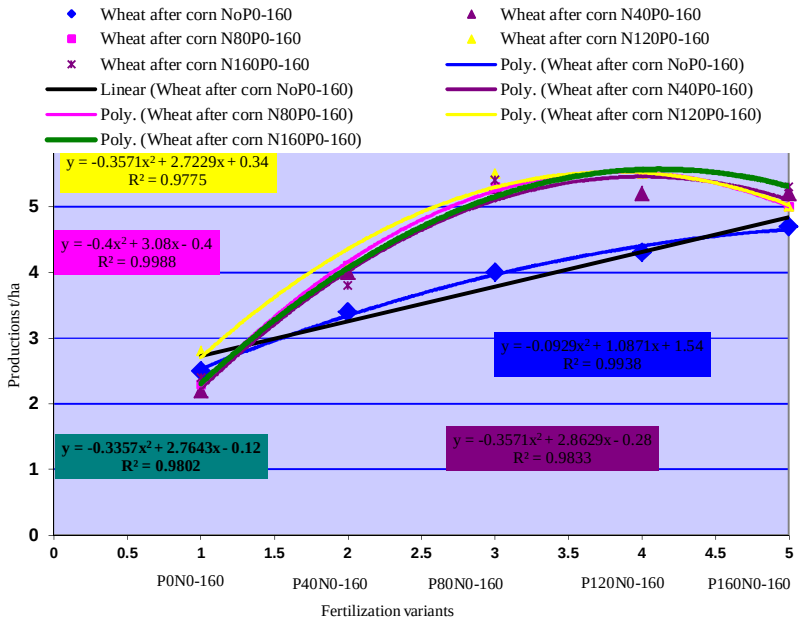

Figure 1. The production curves for wheat crops cultivated following corn crops depending on NP doses

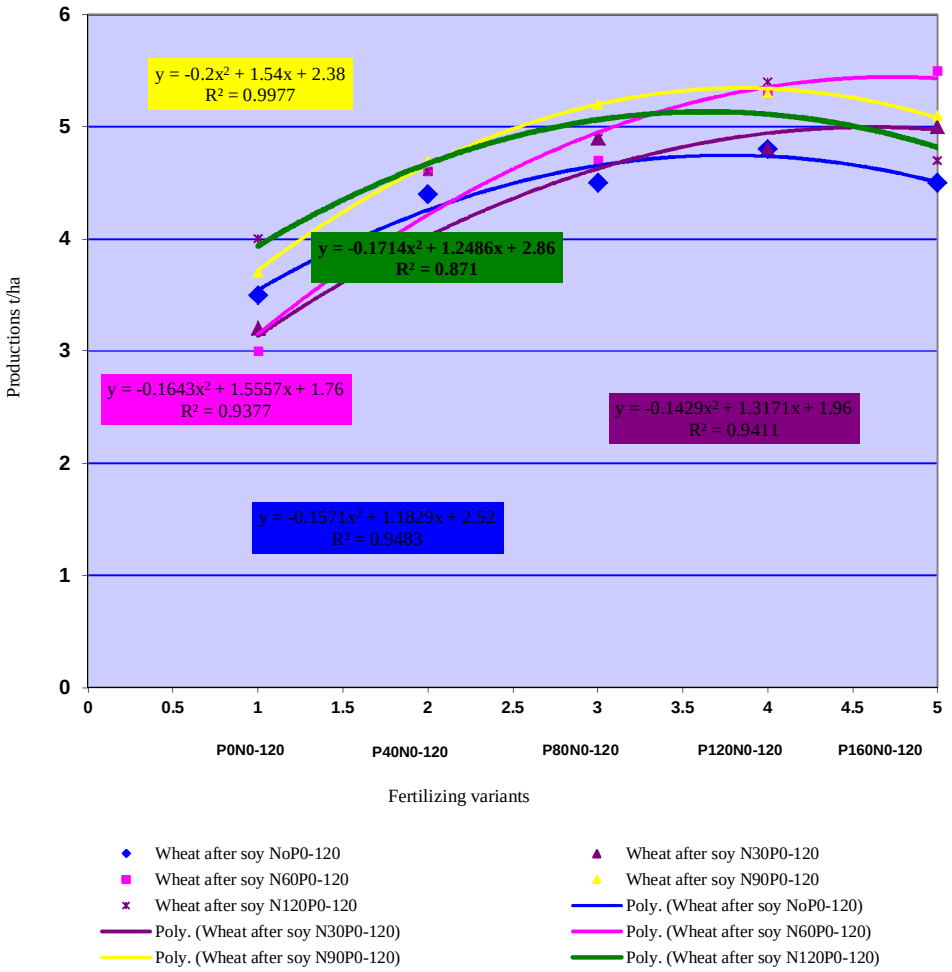

Figure 2. The production curves for wheat crops cultivated following soy crops depending on NP doses

For wheat crops that were cultivated following corn crops the NP doses that emphasize these interactions determines the wheat grains productions, in a larger area, quantitative speaking, between 2,3-2,5 t/ha in comparison with the area determined by this interaction for wheat crops cultivated following soy crops where the wheat grains productions are situated between 3,0-5,5 t/ha. This observation may lead to the interpretation that wheat crops cultivated following corn crops capitalize more effectively the applied NP doses in comparison with wheat crops cultivated following soy crops that includes in the production data also the positive effect of the previous plant crops. In the same context of the observations made, we can state that for the high NP doses, at $N_{120\text{-}160}P_{80\text{-}120}$ level for wheat cultivated after

corn and at $N_{90-120}P_{80-120}$, even higher, for wheat cultivated after soy, the differentiation determined by the previous plant is minimum.

In general, the increase of the nitrogen doses, as a primary fertilizing factor for high and very high levels, on this type of soil that is agro-chemically balanced and very well supplied with phosphorus, cannot be done without an effective support for the phosphating action through application or for the decisive presence of the initial phosphorus level in the soil.

The effect of phosphorus application in terms of argic phaeozem, which is very well supplied with this element, is emphasized on one hand through the insurance and sustaining of NP doses application and on the other hand in determining the stability of the wheat grains production levels (Figure 3 and Figure 4).

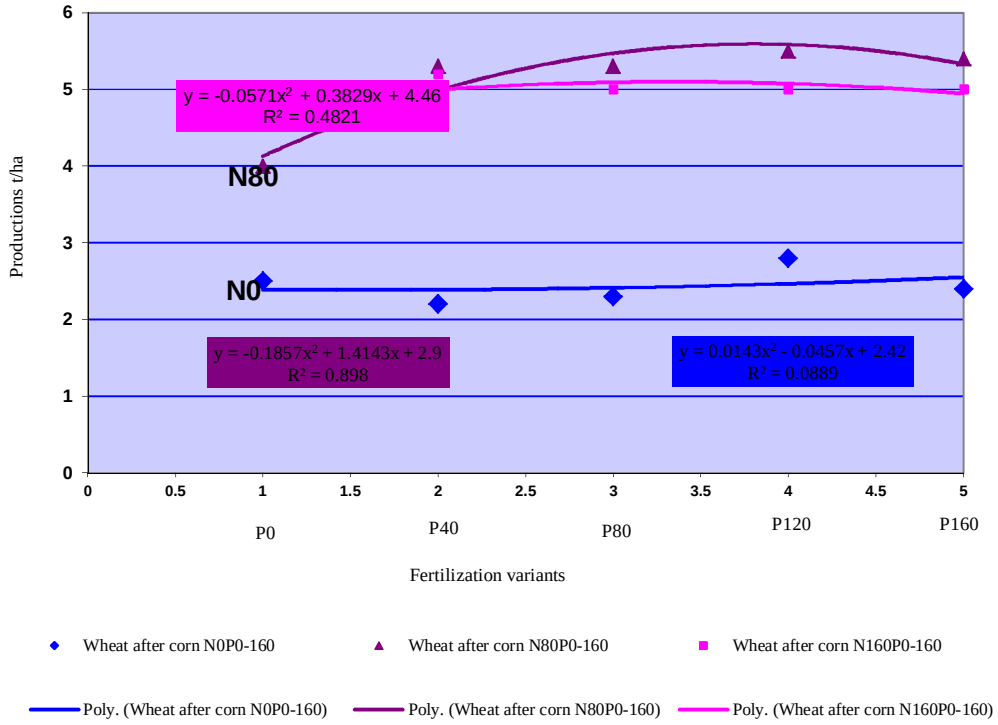

Figure 3. The production curves for wheat crops cultivated following corn crops according the P applied doses

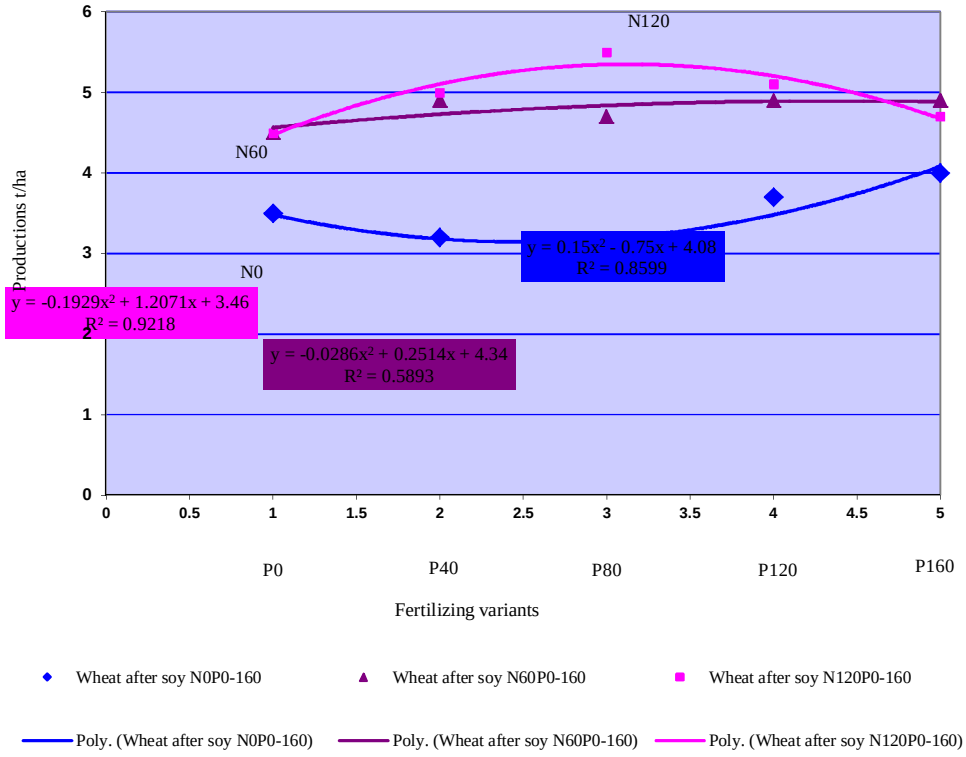

Figure 4. The production curves for wheat crops cultivated following soy crops according the P applied doses

When unilaterally applied phosphorus maintains the production level of wheat at the level of the control variants (unfertilized) and their variability that is determined by increasing phosphorus doses in its interaction with nitrogen, not only insures the increasing effect of nitrogen but also maintains the variability interval of productions at high, adequate levels. These intervals lay constantly for wheat crops cultivated following corn crops between 4,0-5,2 t/ha and for wheat crops cultivated following soy crops between 4,5-5,5 t/ha.

During the further approaches within this study, it will be useful to detach the phosphorus effect due to its native supply from the supply doses effect, both from an agrochemical point of view and also from an economical point of view, because future fertilization strategies, especially those based on long-term experiments must include a dosage rationalization, including a substantiation of the reduction for some mineral inputs.

CONCLUZIONS

The partial results obtained in 2011 regarding the differentiated NP fertilizations effect on an argic phaeozem from SCA Turda lead to assessments regarding the development of a rational fertilization system for wheat cultivated in the agro-, eco-system of the Transylvania Plain. Future research, economically oriented, will be able to provide these

results with a differentiated application level according to the multiple factors that determine the fertilization effect.

The data presented in this research lead to the next conclusions:

1. The productions obtained represent the effect of the positive interaction of the two primary macro-elements (nitrogen and phosphorus) which are essential through their action and they also determine a certain variability due to the size of the applied doses.

2. Nitrogen proved to be essential and decisive in obtaining high quantity wheat grains productions, its efficiency as the doses increase is insured by the high phosphatic content of the soil and the existence of sufficiently high levels of phosphorus.

3. Phosphorus, besides having the sustaining effect of the nitrogen application efficiency is also essential in insuring a certain stability of the production levels for wheat crops.

4. The maximum wheat productions gains for wheat crops cultivated following corn crops were obtained at $N_{120-160}P_{80-120}$ level and for wheat crops cultivated following soy crops at $N_{90-120}P_{80-120}$ level and, in the future a nitrogen doses reduction can be approached in the case of wheat crops cultivated after soy crops, and observing the production curves, the fertilizing contribution of the previous plant is obvious.

5. According to the level of production growth we can estimate that wheat crops cultivated following corn crops capitalize better the increase of the nitrogen dose, having a phosphorus base and we can also state that at high fertilization doses, at the level of high productions, the previous plant's effect is annihilated.

6. Further research will allow the obtaining of some predictable results according to which the agro-chemical effect of the NP interaction will be sustained through economical and rational alternatives for implementing some fertilizing systems adapted to the agro-, eco-system in the Transylvanian Plain.

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