RESEARCH ON THE EFFECT OF MINERAL FERTILIZATION ON POTATO

Constantin TOADER, M. RUSU, Marilena MĂRGHITAŞ, Eva FIT

University of Agricultural Sciences and Veterinary Medicine, Faculty of Agriculture
3-5, Mănăştur Street, 400372, Cluj-Napoca, Romania Phone: +40-264-596384; fax: +40-264-593792;
Corresponding author: costi_toader@yahoo.com

Abstract: *Considered a plant with high specific consumption of nutritive elements (5 – 8 kg N; 2 – 3 kg P; 8 – 9 kg K; 5,1 kg CaO; 3,1 kg MgO; 0,8 kg S on T of vegetal product) results that an average production of tubers on the surface unit (30 – 45 t/ha) gets out of the soil each year huge amounts of nutrients. This reason and the structure on nutritive elements obtained by crops impose differenced fertilization systems which valor the N, K, Ca then P, Mg, S and especially the interaction of applying these in the quantitative and qualitative determination of tuber production. The presented paper reveals the effect of fertilization interactions assured through mineral complex and one-sided fertilizations and without organic contribution on the potato tuber production and the production gain realized in the context of applying different dosages of complex mineral (NP) fertilizer. In the same context, this paper underlines the theoretical and practical importance of complex and balanced fertilization applied to growing potatoes, assured through NP mineral substratum on nutrient accumulation in soils type gelisoil and chernosiom from Cojocna. The effect of these interventions is significant, and the absolute and relative values of this effect are as by as the nutritive substratum insures the presence of more nutrients at levels of sufficient biodisponibility. The effect of NP interaction, in the given experimental conditions, of the gley soil and typical chernozem in Cojocna proves useful and significant for all applied combinations and manifests in the minimum ($N_{40}P_{40}$) and maximum ($N_{160}P_{160}$). dosage. This assertion is valid for all experimental years (2005-2006). Gley soil and typical chernozem experiments in Cojocna confirm the nutrition and fertilization demands of the potato and emphasized the significant effects of complex balanced mineral fertilization with NP, where combinations were achieved with complex fertilizers of the NP type. NP complex mineral fertilization determined production increases (differences) statistically ensured in the $N_{40}P_{40}$ to $N_{160}P_{160}$ domain with diminishing tendencies of increases in the $N_{80}P_{80}$ - $N_{120}P_{120}$ interval. The level of productions obtained with complex mineral NP fertilizations may reach 30-32t/tubers/ha;*

Key words**:** *potato tuber, mineral fertilizer, production*

INTRODUCTION

The mineral fertilizer resources are alternative technologies in definition and delimitation of some differenced and efficient fertilization systems on the potato crop. This fact is necessary and implicit possible through the combined application (complex or mixt) of essential nutrients (NP and NPK) in different combinations, interactions and dosages. Previous researches through field experiences and soil-plant analyses have brought to discussion and in most situations confirmed the nutrient and fertilizing valor of primary macroelements (NPK) in potato crops too, very demanding when it comes to the presence and quantity of these elements, to the essential nutritive balance proven to be extremely useful when it comes to large and qualitative productions at this important crop.

MATERIAL AND METHODS

Experiments realized in the year 2005: on the Cojocna geliosol with the ***Redsec*** potato genre have included the following complex mineral (NP) fertilization method:

- 1. Unfertilized probe;

- 2. $N_{40}P_{40}$;
- 3. $N_{80}P_{80}$;
- 4. $N_{120}P_{120}$;
- 5. $N_{160}P_{160}$.

Experiments made in the year 2006: on the typical Cernozeom from Cojocna with the ***Redsec*** potato genre were made on a similar pattern to the one used in 2005, with the difference that it was placed on a different soil type (typical Cernozeom).

- 1. Unfertilized probe;
- 2. $N_{40}P_{40}$;
- 3. $N_{80}P_{80}$;
- 4. $N_{120}P_{120}$;
- 5. $N_{160}P_{160}$.

RESULTS AND DISCUSSIONS

The effect of the NP interaction in the given experimetal conditions, of the argic cernozeom from Cojocna, it is proven to be useful for all the applied combinations and it manifests rom the minimum dosage ($N_{40}P_{40}$) to the maximum ($N_{160}P_{160}$). This is true for all experimental years (2005-2006) (tables 1, 2 figures 1, 2)

Table 1.

Production results regarding the effect of differentiate mineral fertilization (NP) for potato (year 2005), (Redsec genre)

No.	Fertilization variance	The Average tubers production				
		t/ha	%	Difference t/ha	Significance of difference	Duncan Test
1	Control	28.37	100,0	0,00	Mt.	
2	$N_{40}P_{40}$	29.67	104.6	1.30	**	
3	$N_{80}P_{80}$	31.37	110.6	3.00	***	
4	$N_{120}P_{120}$	31.67	11.6	3.30	***	
5	$N_{160}P_{160}$	32.00	112.8	3.63	***	
	DL(5%)			0.72		
	DL(1%)			1.05		
	DL(0,1%)			1.58		

Table 2.

Production results regarding the effect of differentiate mineral fertilization (NP) for potato (year 2006), (Redsec genre)

No.	Fertilization variance	The Average tubers production				
		t/ha	%	Difference t/ha	Significance of difference	Duncan Test
1	Control	20.27	100,0	0,00	Mt.	A
2	$N_{40}P_{40}$	22.77	112.3	2.50	-	AB
3	$N_{80}P_{80}$	25.40	125.3	5.13	**	BC
4	$N_{120}P_{120}$	26.77	132.0	6.49	***	C
5	$N_{160}P_{160}$	27.50	135.6	7.23	***	C
	DL(5%)			2.92		
	DL(1%)			4.25		
	DL(0,1%)			6.38		

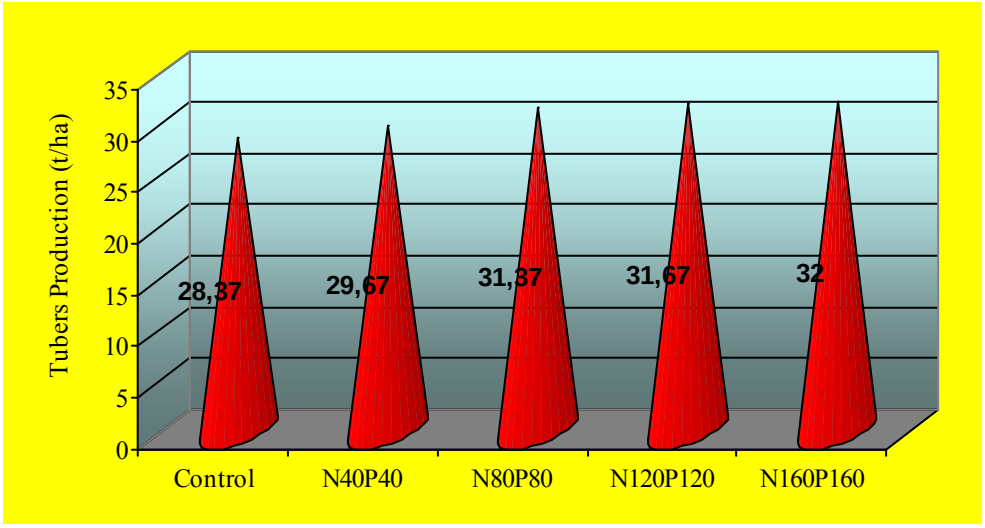

Fig. 1. Interaction of the differentiate mineral fertilization (NP) on the tubers production (2005)

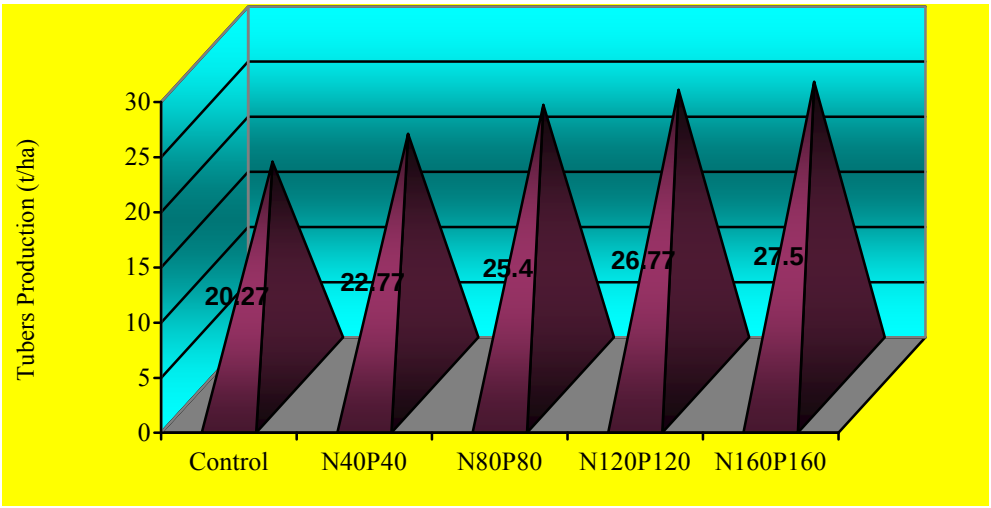

Fig. 2. Interaction of the differentiate mineral fertilization (NP) on the tubers production (2006)

The major effect of combination and mineral interaction NP on the tubers production at the Redsec genre is manifested as level and degree of statistical assurance to the dosage of $N_{80}P_{80}$ the differences and gains of production being significant for the next dosages, but from the mentioned level the productions become flatten and the production gain for the unit of active substance applied is diminishing. The optimal dosages from the agrochemical point of view (DOA) is statistically proven fro productions of 20-35 t/ha tubers in the aisle $N_{80}P_{80}$ – $N_{120}P_{120}$ in the same experimental context the optimal dosages from technical point of view (DOT) are in all agricultural years at the level of $N_{160}P_{160}$ which assures maximal productions from the quantitative point of view for the given conditions from Cojocna, mentioning that the specified soil has a very good level of K mobile which is both natural and from the previous fertilizations.

Potato productions realized at the Redsec genre through complex fertilization NP in mineral exclusivity are situated between 20,27 t/ha – 34,07 t/ha tubers reaching the maximum values only for fertilization with dosages that go over $N_{80}P_{80}$ with the notification that the degree of production in dependence with the applied dosages does not express a direct proportional relation but limited by the reach of a maximum by the tuber to the very high mineral fertilization dosages.

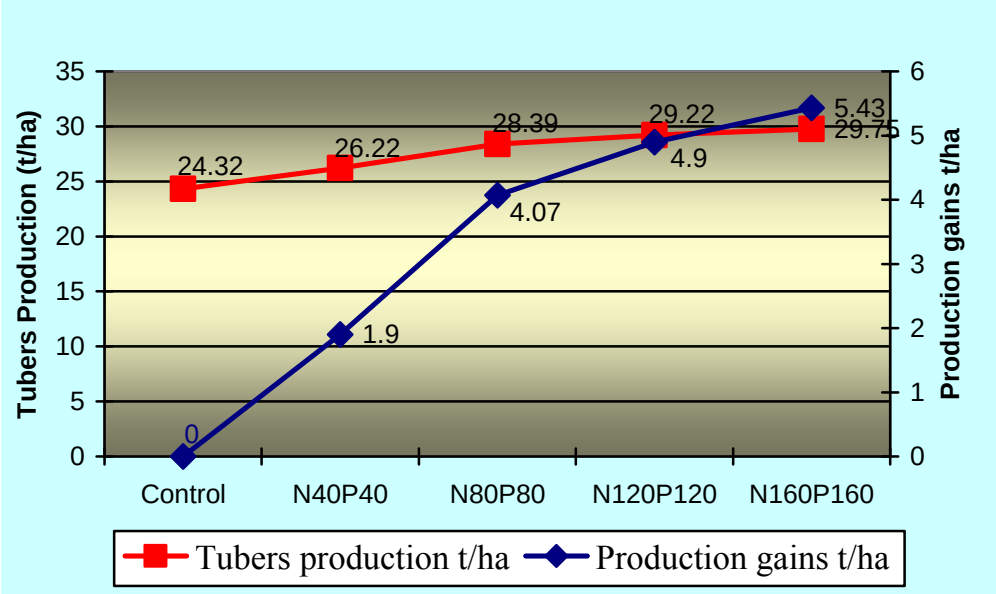

Fig.3. The effect of complex (NP) mineral fertilization on production and production gains of tubers (Redsec genre) (2005-2006)

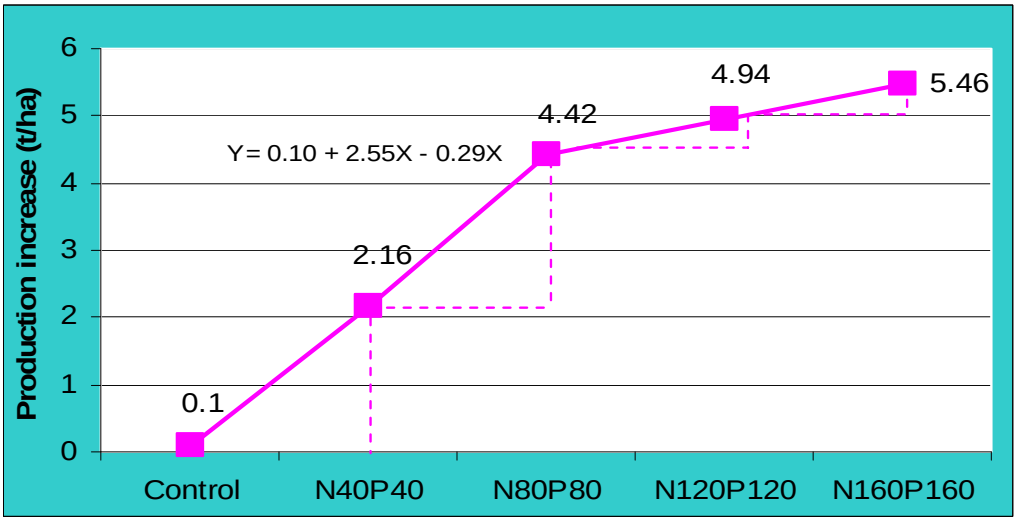

Fig. 4. The effect of complex (NP) mineral fertilization on production and production gains of tubers (Redsec genre) (2005)

• **The curves of tubers production and their gains for the complex NP fertilization**

The graphical representation of the productions and gains realized through complex mineral fertilization NP shows that the positive effect of this fertilization interaction is limited at certain production intervals limited by average NP fertilizations (up to $N_{80}P_{80}$) level after which the effect of mineral fertilization knows a stagnation and decrease (fig. 3., 4.).

Thus the representation of the production curves and their contribution to the tubers harvest shows to technological way that in case of exclusive mineral fertilization, even complex, to lower productions through the effect of the NP interaction one obtains bigger gains, but at the input of high fertilization the gains keep getting lower as the fertilizing dosages increase. This process shows that mineral fertilization, even complex to potato can hold limited effects too due to a less productive usage of the NP nutrients at high and excessive dosages. (table 3).

Table 3.

The evolution of the production gains for tubers per kg s.a. of NP applied under a complex form 2005-2006

The mineral fertilisation variance NP	The total production gain (t/ha)	kg gain/ kg N s.a.	kg gain/ kg P s.a.
Control	-	-	-
$N_{40}P_{40}$	1,90	47,5	47,5
$N_{80}P_{80}$	4,07	50,9	50,9
$N_{120}P_{120}$	4,90	40,8	40,8
$N_{160}P_{160}$	5,43	33,9	33,9

CONCLUSIONS

For the potato culture technologies the fertilization system holds an essential role, assured by its effect upon the potato production and soil fertility;

The phenomenon of diminishing the production gains during the increase of the fertilization input (in this case complex NP, in even proportions) expresses on the one hand the limited effect of one-sided mineral fertilization (NP) without organic support and then the necessity of the implementation of more fertilizing alternatives for potato which could prevent the effect of K and of fertilizing organic resources which can not only supplement nutrients but physically and biologically ameliorate the soil

The above made finding confirms the concepts of BAULE (1918) SPILLMAN (1933), MITSCHERLICH (1905, 1932) and BLACK (1992, 2000) which mention the answers (gains) of crop which are decreasing after an arithmetical progression towards the equal increasing of fertilizing factors. these concepts can put the bases of the differentiation methods of fertilizing dosages (MITSCHERLICH 1905; BLACK, 1992, 2002);

BIBLIOGRAPHY

1. APOSTOL G., CRISTINA COSTACHE, RODICA STĂNESCU, C.BOBIVICĂ, LILIANA BOBIVICĂ, I.CONSTANTINESCU, 2003, Consumul de îngrăşăminte şi starea de aprovizionare a solurilor cu elemente nutritive în vederea unei agriculturi durabile**,** Publ. CIEC. Simp. Internaţional, 30 – 31 oct. 2003, 233 – 238;
2. APOSTOL G., C.SIMIONESCU, GEORGETA BĂLEANU, A. DORNEANU, EMILIA DORNEANU, CRISTINA COSTACHE, RODICA STĂNESCU, I. CONSTANTINESCU, 2006, Cercetări referitoare la îngrăşămintele solide cu acţiune multiplă, Publ. CIEC. Simp. Internaţional, 13–14 iulie. 2005, 337–344;
3. BORLAN, Z., CR. HERA, 1984, Optimizarea agrochimică a sistemului sol – plantă, Ed. Academiei RSR, Bucureşti;

4. BORLAN Z., CR. HERA, O. BUNESCU, 1990, Agrochimia fosforului. Aspecte actuale de interes practic şi ştiinţific, Ed. Ceres, Bucureşti;
5. CIOBANU V., 1993, Rezultatele cercetărilor privind optimizarea dozelor de îngrăşăminte pentru cartof în cadrul unui asolament de 4 ani pe solul cernoziomid de la Suceava, Analele I.C.P.C. Braşov, Vol. XX;
6. LAZĂR RODICA şi colab., 2006, Cercetări privind influenţa fertilizării de lungă durată cu azot şi fosfor asupra unui faeoziom cambic de la Fundulea, Publ. CIEC. Simp. Internaţional, 13-14 iulie 2005, 187–200;
7. MĂRGHITAŞ MARILENA, 2003. Agrochimie**,** Editura AcademicPres, Cluj-Napoca;
8. MĂRGHITAŞ MARILENA, M. RUSU, 2003. Utilizarea îngrăşămintelor şi amendamentelor în agricultură**,** Editura AcademicPres, Cluj-Napoca;
9. NĂSTASE D., MARIA IANOŞI, GH. OLTEANU, GH. PAMFIL, 1996, Unele aspecte privind fertilizarea cartofului în condiţiile solurilor aluviale din Lunca Dunării, Analele I.C.P.C. Braşov, Vol. XXIII;
10. RUSU M. şi colab., 2005, Tratat de Agrochimie, Editura Ceres, Bucureşti.