EFFECT OF FOLIAR FERTILIZERS AS UNCONVENTIONAL INTEVENTION METHODS WITHIN DIFFERETIATED FERTILIZATION SYSTEMS FOR THE MAIZE CROP

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Abstract: *The purpose of the research presented in the paper envision the rationalization of fertilizing mineral inputs and their reduction by promoting certain alternatives for the promotion of alternatives and strategies fo the efficient involvement in differentiated fetilization systems of unconventional resources (foliar fertilizers). Throughout the research period, a study was conducted on the effect of differentiated fertilizations through field experiements in order to assess the differentiation of maize grain productions and nutrient accummulation in the soil and plant, by means of laboratory analyses. The data obtained will be part of an agrochemical optimization model of the soil-plant system in maize crop, by setting the domains of soil fertility maintenance, as well as those of agrochemical risk (insufficiency-defficiecy, excess-toxicity) for grain production.The paper presents the testing of foliar fertilizers in maize crop in the Transylvania area on a chernozem (phaeozem) soil for the quantitative and qualitative increase of maize grain production per hectare. The completion of this paper is due to a series of experiments involving a wide range of foliar fertilizers in the experimental field of the University of Agricultural Sciences and Veterinary Medicine Cluj-Napoca at the SDE Cojocna throughout the year 2010. The production results obtained as a consequence of the experiments reveals the essential character of foliar interventions in the context of an optimal soil supply of nutrition elements. The application of foliar fertilizers in plants has had a complementary role providing higher usage coefficients of the active substance in soil and soil-applied fertilizers. These experiments in researching the effects of certain unconventional fertilization sources (foliar fertilizers) are of the utmost importance, originality and novelty in the field of agrochemistry, due to yet unsoved problems with regard to fertilization combinations: exclusively mineral soil fertilization; exclusively organic soil fertilization; organo-mineral soil fertilization. It is thus clear that the experiments and overall research in the preset paper are up-to-date, useful and aim at the recovery of detrimental situations (agrochemical risk- insufficienty-defficiency; excess-toxicity for grain production) and provide with alternatives for the differentiation of fertilization systems in the field that can include practical solutions that are both agrochemically and economically accessible. These solutions include varieties of complex balanced NP fertilizers and a wide range of balanced foliar fertilizers, as well as organo-mineral ones that can enhance the efficiency of application for soil-incorporated fertilizers and even diminish the mineral input of this intervention. These fertilization alternatives for the potato crop accompanied by a rigorous agrochemical control ensure a diversity of practical solutionns for the achievement of the agrochemical optimum in the soil-plant system. The paper was supported through the project: POSTDOCTORAL SCHOOL IN THE FIELD OF AGICULTURE AND VETERINARY MEDICINE Contract n.: POSDRU/89/1.5/S/62371.*

Key words**:** *productions, nutrients, fertilizers, maize grains*

INTRODUCTION

Maize positively reacts to differentiated fertilization systems, mostly to those that exhibit interactions of the essential elements involved in nutrition and fertility (RUSU MIHAI et al., 2005). As such, maize crop technology has employed fertilization systems that capitalize

on the interaction effect of nitrogen, phosphorus and potassium from complex mineral and organic resources that can forecast and obtain large productions. The present paper aims at presenting the effect of differentiated fertilization systems applied to maize and ensured by means of complex NP mineral fertilizers and foliar fertilizers, as well as investigating the possibility for the reduction of NP doses applied to the soil by supplementing and regulating nutrition through extraradicular varieties that are nutritively balanced.

MATERIAL AND METHODS

Field experiments were conducted on a cambic chernozem in Cojocna, with the specific pedo-agrochemical indicators for this soil type in the Transylvania Plain (table 1).

Table 1

The pedo-agrochemical traits of the cambic chernozem in Cojocna

Determining indicator / Horizon/Depth (cm)		Amp 0-25	Am 25-40	AC 40-60	C_1 60-80	C_2 80-130
Physical and chemical properties						
pH_{H2O}		7.40	7.50	7.86	7.90	7.85
$CaCO_3$%		0.4	0.6	3.0	10.4	14.9
Humus (%)		7.10	5.45	2.20	1.13	-
P – AL(ppm)		13.0	3.1	10.0	3.0	6.1
K – AL(ppm)		330.3	180.1	131.1	93.0	117.8
Da(g/cm^3)		1.04	1.15	1.31	1.42	1.48
Granulometric analysis	Coarse sand (2.0-0.2mm)	8.9	10.8	15.5	0.5	0.7
	Fine sand (0.2-0.0 mm)	28.9	25.5	27.4	17.7	14.4
	Dust (0.0-0.002mm)	16.9	12.5	17.8	36.0	38.9
	Clay (<0.002mm)	45.3	45.2	39.3	45.8	46.0

The experiments included five graduations of complex mineral fertilization(N_0P_0; $N_{40}P_{40}$; $N_{80}P_{80}$; $N_{120}P_{120}$; $N_{160}P_{160}$), five graduations of folair fertilizer assortments (Fertifam 31; Ecofertil P; Fertcomplex C; Cerasil 106; Cerasil 107) and five graduations of complex soil and foliar fertilization (Multifertil 5-10-10, on a complex mineral background diminished to ½ of the initial block dosis).

Soil-plant analyses were conducted according to ICPA methodology for agrochemistry laboratories.

RESULTS AND DISCUSSIONS

Production results certify the positive effect of complex mineral fertilization applied to the soil, its main trait, determined in the level and stability of the grain production per surface unit (table 2).

Table 2.

Effect of differentiated – soil and foliar- fertilization in maize crop

No.	Level of fertilization N/P_2O_5 (kg a.s./ha) + foliar fertilizers	Productions		±Differences (t/ha)	Signficance
		(t/ha)	%		
1	0 + 0 + 0 (control)	6.384	100.0	0.00	Control
2	40/40	7.077	110.9	693.00	-
3	80/80	6.966	109.1	582.00	-
4	120/120	6.656	104.3	271.67	-
5	160/160	6.600	103.4	215.33	-
6	Fertilfam	7.297	114.3	912.67	*
7	Ecofertil	6.872	107.6	487.67	-
8	Fertcomplex C	6.839	107.1	454.33	-
9	Cerasil 106	6.052	94.8	-332.00	-
10	Cerasil 107	6.088	95.4	-296.00	-
11	Multifertil 5-10-10	6.639	104.0	254.33	-
12	Multufertil 5-10-10 +20/20	6.911	108.2	526.33	-
13	Multufertil 5-10-10 +40/40	6.883	107.8	498.67	-
14	Multufertil 5-10-10 +60/60	6.870	107.6	485.33	-
15	Multufertil 5-10-10 +80/80	6.907	108.2	522.67	-
	DL (5%)			774.98	
	DL (1%)			1043.39	
	DL (0.1%)			1387.40	

The maximum maize grain production per surface unit is obtained on an average dosis of nutrients ($N_{80}P_{80}$) that provide a positive interaction of the two macroelements essential for a real nutritional balance. The exceeding of the mentioned NP dosis determined a decrease of production and a poorer capitalization of nutrients.

The highest grain productions are obtained through the complex NP interaction, applied to the soil alongside foliar fertilization (Multifert 5-10-10), where soil doses are ½ lower than the initial ones. In this context, it is clearly emphasized that the two measures- soil and foliar fertilization- are in mutual and positive interaction and influence, as well as enhancing their efficiency when applied in combination. This phenomenon makes it clear that soil fertilization plays an essential part while the foliar one plays a secondary and complementary one, for the regulation of the fertilization system applied to the soil.

Exclusive and one-sided foliar fertilization applied to the maize crop determines inferior production results compared to soil fertilization, as well as soil+foliar one, which supports previous assertions.

Differentiated fertilization systems applied to the maize crop positively and systematically influence the relevant indices of soil fertility and maize nutrition (table 3, 4)

The application of complex NP fertilizers positively modifies the regime of nutrient accumulation and bioavailability in the soil.

Nutrient accumulation in grains show the system and level of fertilization, as well as the agrochemica state of soil nutrients.

It is thus obvious that one-sided foliar fertilization exerts a significant influence on a complex NP background, in the regulation and accumulation of plant nutrients. The positive effect of the interaction of complex balanced fertilization applied to the soil alongside the foliar one is more significant in the process of mineral nutrition in maize.

Table 3.

Effect og differentiated fertilization on the cambic chernozem in Cojocna

No.	Level of fertilization N/P_2O_5 (kg a.s./ha) + foliar fertilization	Main agrochemical soil indices at a 0-20cm depth					
		pH_{H2O}	H (%)	I_N	P-AL (ppm)	K-AL (ppm)	V(%)
1	0 + 0 + 0 (control)	5.73	3.52	2.41	52	230	68.5
2	40/40	5.67	4.56	3.12	56	240	68.5
3	80/80	5.80	4.52	3.08	64	270	68.2
4	120/120	5.75	4.86	3.34	72	300	68.9
5	160/160	5.66	4.70	3.18	84	300	67.8
6	Fertilfam	5.55	4.58	3.09	76	250	67.5
7	Ecofertil	5.56	4.58	3.09	92	230	67.6
8	Fertcomplex C	5.39	4.10	2.74	124	240	66.9
9	Cerasil 106	5.65	4.40	2.97	212	280	67.7
10	Cerasil 107	5.40	4.28	2.86	138	280	67.0
11	Multifertil 5-10-10	5.66	3.98	2.70	64	210	67.9
12	Multufertil 5-10-10 +20/20	5.84	4.94	3.49	148	500	70.5
13	Multufertil 5-10-10 +40/40	5.70	5.18	3.56	168	330	68.9
14	Multufertil 5-10-10 +60/60	5.63	5.08	3.43	232	310	67.7
15	Multufertil 5-10-10 +80/80	5.77	5.10	3.57	254	300	70.0

Table 4.

Influence of differentiated fertilization on nutrient accummulation in maize grains

No.	Level of fertilization N/P_2O_5 (kg a.s./ha) + foliar fertilizers	N %	P_t %	K_t %	Ca %
1	0 + 0 + 0 (control)	1.50	0.20	0.73	0.80
2	40/40	1.80	0.35	0.92	1.05
3	80/80	1.80	0.37	0.73	1.10
4	120/120	1.80	0.45	0.73	1.20
5	160/160	1.50	0.48	0.84	1.25
6	Fertilfam	1.95	0.28	0.73	1.00
7	Ecofertil	2.10	0.28	0.84	1.05
8	Fertcomplex C	1.95	0.26	0.73	1.07
9	Cerasil 106	2.10	0.26	0.92	1.27
10	Cerasil 107	2.40	0.26	0.73	2.10
11	Multifertil 5-10-10	1.65	0.21	0.80	0.95
12	Multufertil 5-10-10 +20/20	1.95	0.46	0.84	1.40
13	Multufertil 5-10-10 +40/40	2.10	0.48	0.84	1.45
14	Multufertil 5-10-10 +60/60	2.40	0.51	0.92	1.60
15	Multufertil 5-10-10 +80/80	1.80	0.54	0.98	2.10

CONCLUSIONS

Maize dispays an efficient response, through production increases and balanced nutrition, to fertilization systems relying on the application of complex NP soil fertilizers and its interaction with foliar fertilization.

One-sided and exclusive foliar fertilization does not provide significant production increases, which justifies its secondary role compared to complex and balanced mineral NP fertilization applied to the soil.

Foliar fertilization provides, especially on a complex mineral background applied to the soil, an onvious regulation of nutrition and leads to an efficient nutrient accumulation in the plant.

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