POSSIBILITIES FOR THE RATIONALIZATION AND REDUCTION OF FERTILIZING MINERAL INPUTS (DOSES) WITH REGARD TO THE EFFICIENT INPUT OF FERTILIZING ORGANIC RESOURCES FOR THE MAIZE CROP

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Abstract: *Present-day debate worldwide, including certain nationwide approacges lead towards highly-diversified trends for the implementing of agriculture systems that involve to a higher or lesser extent the employment of feritilizers for their success. At the same time, however, they are called to provide food amounts that are both quantitative and qualitative appropriate, while increasing soil fertility and providing environmental protection. Bearing in mind the scientific basis, as well as the complex food chain effect, all agriculture systems cand be improved and cannot ultimately achieve all objectives set by human society, consumers and soil fertility requirements.In this context, the present paper aims at promoting organic fertilizing resources (stable and poultry manure) and reducing mineral fertilizers, on the grounds of the fact that organic feritlizers are easier to obtain, at lower costs, while soil fertility is manintained on a sustainable and ecologic term, compared to mineral fertilizing resources. In order to attain the previously-set objectives, field experiements were conducted at SDE Cojocna of the University of Agricultural Sciences and Veterinary Medicine, in 2011. They were set on a cambic chernozem, for maize crop, involving different fertilizing resources, mineral-from NP complex fertilizers, organic- from semifermented stable and poultry manure. The present paper reveals certain experimental results obtained through the application of differentiated mineral fertilizers (from complex NP fertilizers), organo-mineral ones (semifermented stable and poultry manure and complez NP fertilizers) and organic ones from semifermented stable manure (20t/ha) and poultry manure (12t/ha). The differentiated application of fertilizers highlights the importance of such combinations as the organo-mineral ones with stable manure, as well as poultry manure, where the grain production increases significantly compared to the (unfertilized) control. With regard to exclusively mineral fertilizing variants, production increases for increased NP doses are insignificant compared to the organo-mineral variant with a minimum NP dosis ($N_{50}P_{50}$), in the case of stable manure, as well as poultry manure. The experience of European countries and Romania alike, at least during the last 50 years, including intensive conventional agricultural practices or one-sided technological activities, have led to the spread of disturbing processes and phenomena for the environment towards de degradation of the soil's paramount quality- its fertility. The factors of physical, chemical, biologic and technologic degradation of soils have extended and increased, while areas subjected to erosion and compacon have expanded, as well as areas degraded by polluation and the destruction of fertility. The nutrient cycle is thus blocked, while more areas show the potential of desertification. The impact of these modifications is increasingly higher in the past period due to global climate change, as in such conditions, the factors involved in the degradation of fertility become more active and more unpredictable. As such, long-term and sustainable fertility of soils has become paramount in supporting ecological balance amd incresing the safety of plant and animal production. Therefore, such research as the hereby one are beneficial for agricultural practice to increase the quality and quantity of production and provide food safety and security. The paper was supported by the project – POST-DOCTORAL SCHOOL IN THE FIELD OF AGRICULTURE AND VETERINARY MEDICINE Contract n.: POSDRU/89/1.5/S/62371*

Key words**:** *productions, nutrients, stable manure, poultry manure, maize grains*

INTRODUCTION

Modern agrochemistry, and more specifically, the charatcerisation and support of organic-C accummulation tackles in soils highlights the idea that the humified organic matter is the reservoir and depositary of chemical energy, related to plants through photosynthesis and its enthropy (LAL R., 2002), (BEYER L et al., 2002). According to this conception and the variants involved, the humus quantity and quality exerrt major roles in the maintenance and evolution of soil fertility. In assessing the part that humus and humification play in soil evolution, the soil si regarded as a system that aims towards a stationary state, by equalizing energy and susbstance input, while the application of solely mineral forms and resources of fertilizing elements interferes with the evolutive process of fertility, by means of unstable theromodynamic states. On the other hand, the introduction of organic fertilizing resources increases the heterogeneity and decreases the enthropy increases humification support for the long-term, as well as soil quality, fertility and productivity. This *energetic* concept reveals the involvement of soil organic matter with the fertility state, *harmonizes* the indices of the humiferous regime with those that relevantly express an increase in soil fertility.

Fertilization practice shows that the employment of organic fertilizers does not only meet the requirements of soil fertility and productivity increase, but also, devoid of any fossil energetic input, favourably modify the nutrient reserve. This is due to the fact that organic fertilizing resources have a complez nutritive composition that may provide support for nutrition on a sustainable and multiannual level. This fertilization support through organic fertilizers is enhanced by the formation of organo-mineral compunds that exhibit adsorbtion and cation exchange traits. The enhanced fertilizing level is fruther enhanced by the energizing effect of plastic (organic) substances for the soil fauna and microflora, of microorganisms, as well as positive influences in elementary particle aggreggation and structure for the soil mass.

MATERIAL AND METHODS

Experiments were placed in 2011 at SDE Cojocna of the University of Agricultural Sciences and Veterinary Medicine Cluj-Napoca, on a cambic chernozem soil, exhibiting the following physico-chemical traits (table 1):

Table 1.

Pedo-agrochemical traits of the chernozem (SRTS – 2003) – Cojocna

Determining indicator		Horizon/Depth(cm)				
		Amp 0-25	**Am 25-40**	**AC 40-56**	**C_1 56-78**	**C_2 78-130**
Physico-chemical traits						
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 (2,0-0,2 mm)	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 (0,0-0,002)	16,9	12,5	17,8	36,0	38,9
	Clay (<0,002 mm)	45,3	45,2	39,3	45,8	46,0

From a physical point of view, the soil exhibits a high quantity of clay, with a clayey texture from surface horizons. Thus, it has a high cation exchange ability, but alsoa high water

retention potential, which limits the airhydric regime of the soil. On the surface, the soil has an apparent low density, which reduces porosity and enhances compaction.

From an agrochemical point of view the soil exhibits a weal alkaline reaction, a high humus content, a low P and high K content. It shows good fertility and productivity.

Field experiment pattern and variants have included differentiated fertilization factors achieved through the employment of complex NP mineral fertilizers (20-20), organo-mineral ones (with an organic support formed of semi-fermented stable manure or poultry manure in interaction with complex NP mineral fertilizers), as well aas organic ones (semi-fermented stable manure - 20t/ha and poultry manure 12t/ha (according to the following pattern:

- V_1 = Unfertilized control;
- V_2 = N_0P_0+12t/ha poultry manure;
- V_3 = N_0P_0+20t/ha stable manure;
- V_4 = $N_{50}P_{50}$+12t/ha poultry manure;
- V_5 = $N_{50}P_{50}$+20t/ha stable manure;
- V_6 = $N_{50}P_{50}$;
- V_7 = $N_{100}P_{100}$;
- V_8 = $N_{150}P_{150}$;
- V_9 = $N_{200}P_{200}$;

RESULTS AND DISCUSSIONS

Mineral fertilizing resources are technological variants in defining and setting differentiated and efficient fertilization systems for maize crop. This aim is necessary and implicitly achievable through the combined application (complex or mixed) of essential nutrients (NP and NPK) in different combinations, interactions and doses, while the combined application of different organic resources yields more significat results and aims at the protection of soil fertility.

Fertilization practice shows that the employment of organic fertilizers does not only meet the requirements of soil fertility and productivity increase, but also, devoid of any fossil energetic input, favourably modify the nutrient reserve. This is due to the fact that organic fertilizing resources have a complez nutritive composition that may provide support for nutrition on a sustainable and multiannual level. This fertilization support through organic fertilizers is enhanced by the formation of organo-mineral compunds that exhibit adsorbtion and cation exchange traits. The enhanced fertilizing level is fruther enhanced by the energizing effect of plastic (organic) substances for the soil fauna and microflora, of microorganisms, as well as positive influences in elementary particle aggreggation and structure for the soil mass.

Table 2.

Production results on the effect of organo-mineral fertiliation in maize grains (2011), (Hybrid - Monsanto Dekalb 4626)

N.	Fertilization variant	Average grain production				
		t/ha	%	Difference t/ha	Significance of difference	Duncan Test
1	Control	7,24	100,0	0,00	Mt.	A
2	12t/ha poultry manure	7,58	104,7	0,34	***	A
3	20t/ha stable manure	7,32	101,2	0,09	-	B
4	12t/ha poultry manure + $N_{50}P_{50}$	8,27	114,2	1,03	***	C
5	20t/ha stable manure + $N_{50}P_{50}$	8,34	115,3	1,11	***	CD
6	$N_{50}P_{50}$	8,21	113,4	0,97	***	CD
7	$N_{100}P_{100}$	8,29	114,6	1,06	***	D
8	$N_{150}P_{150}$	8,52	117,8	1,29	***	E
9	$N_{200}P_{200}$	8,55	118,1	1,31	***	E

DL(5%) = 0,09; DL(1%) = 0,12; DL(0,1%) = 0,17.

The application of complex NP fertilization, on an organic agrifund with 12t/ha poultry manure and 20 t/h stable manure mobilizes nutrients in the organic fertilizers into accessible forms. Additionally, it makes the reserves applied through differentiated NP mineral doses readily available. It is useful to assess, for the efficiency of organo-mineral combinations, that the application of the organic resource in these differentiated systems enhances the qualitative effect of the complex mineral fertiization (NP) even in the case of minimum doses ($N_{50}P_{50}$). Maximum NP doses that are exclusively mineral have exhibited values close to the minimum, but on an organic background including organic fertilization with no mineral input with poultry manure have supported the maize grain productionfor levels that are significantly distinct from the unfertilized control. It is thus proven and useful for practice the recommendation that the two types of fertilization-mineral and organic-do not exclude eachother but on the contrary, interact positively and condition eachother.

This recommendation becomes, according to the results obtained, highly efficient and useful for technologies that aim at obtaining high and constant maize production for a surface unit (that surpass 8-9 t/ha). It si certain that organomineral combinations for maize crop protect soil fertility on a sustainable term and limit agrochemical risk domains that may endanger the ecosystem.

The graphic representation of productions and production increases for the effect of organic combinations (poultry manure and semifermented stable manure), organo-mineral ones (formed of stable manure and complez NP doses) show that the positive effect is encountered in organo-mineral fertilization and the mineral one, but with slightly different effects between them, which leads us to assess that organo-mineral fertilization with minimum mineral fertilizer doses is an alternative recommended instead of exlcusively mineral fertilization, even in the case of high doses ($N_{200}P_{200}$). (fig. 1).

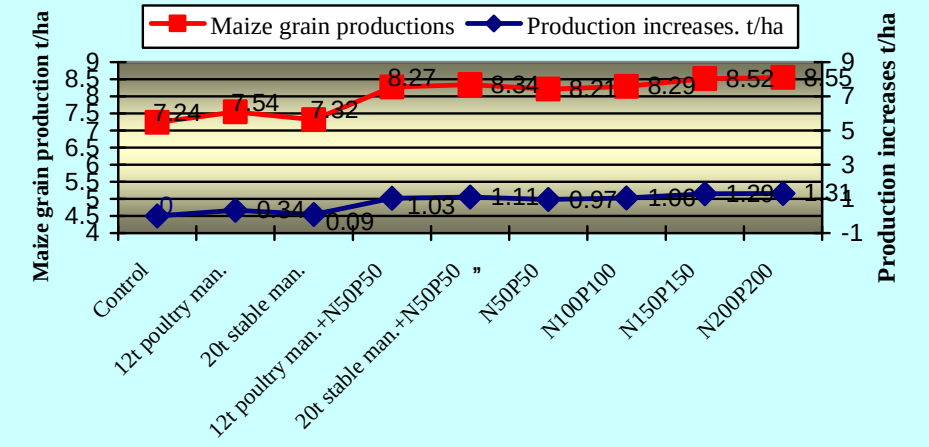

Figure 1 Effect of organomineral fertilization in maize grains on productions and production increases (2011), (Hybrid - Monsanto Dekalb 4626)

Curve of production increases for maize grains that expresses their mathematical dependency on organo-mineral doses (manure and poultry manure+NP) shows a clear linearity and a constant incidence of this interconditioning that recommends for practice, superior possibilities for an increase in grain production by capitalizing on the organo-mineral combinations. Production increases remain sufficiently constant in the case of high and very high doses of mineral combinations, while their effect can be possibly capitalized by mutual effect enhancement. This constancy and liniar dependency of production increases related to an

increase of mineral interaction doses show the superiority of organo-mineral fertilizationson maize grain production compared to the one-sided mineral one that may reach domains of limits for the effects of doses applied.

CONCLUSIONS

Organomineral fertilization is determining in achieving high productions in maize crop, as well as in providing a good interacion of mineral NP elements (at a complex level) with an applied organic substratum. It can be mentioned that solely the application of stable manure devoid of NP mineral support does not yield significant productions compared to the unfertilized control. However, poultry manure, more concentrated in nutritive elements provides signfiicant production increases compared to the control variant.

Complex mineral fertilization is distinctively significant in efficiency on the first NP doses and reaching maximal production in the case of the highest doses ($N_{200}P_{200}$), rpoving that the soil shows a positive reponse to mineral application, that are made available for the plant upon the first growth phenophases.

Analiza sporurilor producției de boabe obținute prin fertilizările diferențiate – la sol – relevă importanța realizării acestora ca efect al interacțiunilor realizate prin aceste sisteme, atât în cazul fertilizărilor organo-minerale cât şi în cazul fertilizărilor exclusiv minerale.

The analysis of production increases for grains obtained through differentiated fertilization- on the soil- reveals their importance as an effect of the interaction achieved through these systems, in the case of organomineral fertilizations, as well as exlcusively mineral ones.

The paper was supported by the project – POST-DOCTORAL SCHOOL IN THE FIELD OF AGRICULTURE AND VETERINARY MEDICINE Contract n.: POSDRU/89/1.5/S/62371

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