RESEARCHES REGARDING THE INFLUENCE OF DEEP LOOSENING AND FERTILIZATION, ON SOME CHEMICAL SOIL MODIFICATIONS AND OF HARVEST, IN THE PRELUVOSOILS CONDITIONS, FROM ORADEA

CERCETĂRI PRIVIND INFLUENȚA AFÂNĂRII ADÂNCI ŞI FERTILIZĂRII ASUPRA UNOR MODIFICĂRI CHIMICE DIN SOL ŞI RECOLTEI ÎN CONDIȚIILE PRELUVOSOLULUI DE LA ORADEA

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Abstract: *The paper reports on the influence on the deep loosening performed with different tools (PP.3-30 plough, chisel and MAS-60) of amendment and fertilization on the chemical indices(soil reaction, nitric and ammonium nitrogen) of the preluvosoil from Oradea and in the maize harvest.*

Rezumat: *Lucrarea prezintă rezultatele privind influența afânării adânci realizată cu diferite unelte (plug, PP. 3-30, cizel şi MAS -60), a amendării şi fertilizării asupra indicilor chimici (reacția solului, conținutul în azot nitric şi amoniacal) ai preluvosolului de la Oradea şi asupra recoltei de porumb.*

Key words*: deep loosening, amendment, fertilization, chemical indices of soil, maize harvest.*
Cuvinte cheie*:afânare adâncă, amendare, fertilizare, indici chimici ai solului, recolta de porumb.*

INTRODUCTION

The good effect of deep loosening in improving the "aero-hidric" and nutrition conditions of heavy and settled soils especially of the albic luvisols was pointed out by a lot of researches (1, 2, 4). For the conditions specific to preluvosoil is available less research information (3, 5, 6).

In this paper are brought contributions regarding the deep loosening influence with different devices, amendment and fertilization influence on some preluvosoil chemical indices from Oradea.

The researches of whose results are presented are very important, because in the high Plane of the "Crisuri" the preluvosoil occupies over 25.000 ha, areals which require the application of some measures of increasing the production potential.

MATERIALS AND METHOD

Climatic, the area is characterized through some values of the medium temperature through the years of the air of $10,2^0$C and rainfalls of 621 mm. The research years were characterized through different climatic conditions, unfavourable to the spring crops and especially to the maize on which besides the few rainfalls from May. June and July were associated even high temperatures in the pollination and forming period of the grain, a lot of plants remaining fruitless or with little maize cobs and little grains.

The soil presents properties typical of preluvosoil. To notice is the high content of clay in Bt horizon (40% colloidal clay, respectively 53% physic clay),fact that negatively influences the porosity ,the resistance to penetration ,the saturated hydraulic conductivity and indicates the need for soil's deep loosening .

The main chemical indices of the soil stand out a moderate acid reaction ,the absence of $CaCO_3$ on the profile ,a middle content of mobile aluminium and a weak provisioning with humus ,total nitrogen ,phosphorus and mobile potassium .

The values of these indices show the requirement for correcting the soil reaction through the application of the amendment and the requirement of improving the provisioning stage with the main nutritive elements, through mineral and organic fertilization.

The cognition of the most important physical and chemical limitative indices of the fertilization of the researched preluvosoil ,permitted the elaboration of some experimental device in which were included measures of there improvement. Was placed in the field a polyfactorial experience, set after the method of subdivided lots ,with two 3X8 factors .The deep loosening factor with 3 graduations includes 3 loosening equipments:PP.3-30 plough, chisel and MAS 60. The amendment-fertilization factor with 8 graduations is presented in the number one table. The cultivated plants were: Turda 200 maize, Alex wheat, Somesan oat and Comun of Transilvania trifolium.

RESULTS AND DISCUSSION

Results are presented regarding the modifications of some chemical indices of the soil (soil reaction, nitric and ammonium nitrogen content) as their influence on the maize harvest in the first year of the effect of the loosening.

a) Modifications of some chemical indices of the soil (Table 1)

-The soil reaction, moderate acid in the initial field, goes in the less acid domain on the depth of the ploughed layer, after the application of the amendment (5t/ha $CaCO_3$), of the manure(50 t/ha) or of the mineral fertilizers (N-120,P-100,K-80 kg/ha a.s.) dose established as optimum in haplic luvisol conditions from Oradea. Is noticed the best influence in the decreasing of soil's acidity of the $CaCO_3$ associated with manure or even singular application. On the layers of the soil from 20-40 and 40-60 cm, the effect of the amendment and fertilization is more reduced ,the pH values of the soil presenting just a trend of attenuation of the acidity, without passing in another class of reaction ,the soil remaining moderate acid. The soil reaction does not present meaningful differences depending on the utilized equipment for loosening.

-The nitric and ammonium nitrogen soil's content as well as the ratio of the two forms of nitrogen presents positives modifications in order to improve the provisioning stage of the soil with mineral nitrogen, after the application of the mineral and organic fertilizers as of the increase of the values of the ratio between the two forms of nitrogen, especially on the soil loosed layer in which were created favourable conditions for the processes of the nitrification. So the soil is passing from the middle content class in the big content class, fact that is very well pointed out till 40 cm of depth at the chisel work and till 60 cm at the loosening with MAS 60.

b) The effect of the loosening and the fertilization of the soil on the production.

At the maize crop, the level of the harvest obtained in the first year, after loosening and fertilization is medium placed between 27 -46 q/ha (table 2)

-The loosening factor has influenced the obtaining of some very meaningful increases of 15-20%(4.9-6.6 q/ha),comparing with the normal ploughing .The best results were obtained at the loosening with MAS 60,at which the increase was higher with 5% than the loosening with the chisel.

-The fertilization factor in the 8 researched graduations influenced the obtaining of some increases medium distinct and very meaningful of the maize harvest, comprised between 17-71%, respectively 4.7-19.2 q/ha grains. In the researched haply luvisol conditions, the

application of $CaCO_3$ in 5t/ha dose, increased the harvest on an average of 17% on all the 3 ways of loosening, comparing with the unamended and unfertilized soil. The manure in 50 t/ha dose realized the medium increase of 29 %(7.9 q/ha)and the mineral fertilizers in N-120 P-100 K-80 kg/ha a.s have realized the increase of 36%(9.9 q/ha).The association of the loosening at the organic fertilization increases the effect of the manure with 11%, of mineral fertilizers with 14% and of the combination manure+NPK with 12%.The best results were obtained at the combined application of manure+fertilizers+$CaCO_3$, case in which the increase of the harvest comparing with the unfertilized and unamended soil is of 71%(19.2 q/ha)

Table 1

Modification of soil reaction, nitric and ammonium nitrogen content, under deep loosening and fertilization influence, in preluvosoil from Oradea.

Depth	0-20 cm				20-40 cm				40-60 cm			
VARIANT	pH (H_2O)	N-NO_3	N-NH_4	N-NO_3 N-NH_4	pH (H_2O)	N-NO_3	N-NH_4	N-NO_3 N-NH_4	pH (H_2O)	N-NO_3	N-NH_4	N-NO_3 N-NH_4
		ppm				ppm				ppm		
PP.3-30 PLOUGH												
Witness -0	5.58	2.9	2.4	1.2	5.60	4.7	1.7	2.7	5.64	6.5	4.9	1.3
$CaCO_3$-5t/ha	6.14	4.0	2.1	1.9	5.88	4.4	1.8	2.4	5.65	9.0	5.7	1.6
Manure-50 t/ha	5.70	3.9	1.6	2.4	5.81	5.7	2.3	3.0	5.58	8.2	4.0	2.0
NPK	5.67	3.9	2.1	1.8	5.35	5.7	2.3	2.5	5.60	7.9	5.5	1.4
Manure+$CaCO_3$	6.35	5.2	1.4	3.5	5.80	6.2	2.6	2.4	5.54	7.9	4.4	1.8
NPK+$CACO_3$	6.06	2.2	1.3	1.7	5.66	5.4	2.6	2.1	5.56	2.7	3.4	0.8
Manure+NPK	5.81	16.0	3.4	4.7	5.66	7.0	2.7	2.6	5.54	5.7	4.1	1.4
Manure +NPK+$CaCO_3$	6.19	16.6	3.8	4.4	5.77	5.4	2.2	2.4	5.57	4.2	5.5	0.8
CIZEL												
Witness -0	5.59	2.5	2.2	1.1	5.56	5.5	1.7	3.2	5.58	3.9	3.4	1.1
$CaCO_3$-5t/ha	6.61	1.4	1.4	1.0	5.98	7.0	2.2	3.2	5.75	5.3	2.7	1.9
Manure-50 t/ha	6.32	2.0	1.8	1.1	6.02	6.0	2.0	3.0	5.70	6.6	3.4	1.9
NPK	6.19	3.7	3.3	1.1	5.55	6.8	2.2	3.1	5.64	5.3	2.7	1.9
Manure+$CaCO_3$	6.54	3.8	2.3	1.6	5.68	8.0	2.7	3.0	5.60	7.6	3.0	2.5
NPK+$CACO_3$	6.26	4.8	2.2	2.2	5.60	9.6	2.8	3.4	5.57	7.6	2.8	2.7
Manure+NPK	6.23	13.7	3.5	3.9	5.60	8.2	2.6	3.1	5.71	6.6	3.0	2.2
Manure +NPK+$CaCO_3$	6.32	15.7	3.9	4.0	5.71	10.9	2.6	4.2	5.75	4.2	3.1	1.3
MAS-60												
Witness -0	5.63	1.6	1.5	1.1	5.67	10.7	3.3	3.2	5.48	13.0	2.8	4.6
$CaCO_3$-5t/ha	6.57	2.4	2.1	1.1	6.28	8.7	2.7	3.2	5.75	11.8	3.4	3.5
Manure-50 t/ha	6.44	1.9	1.4	1.3	5.76	13.5	4.5	3.0	5.69	10.4	2.8	3.7
NPK	6.25	7.9	1.5	5.3	5.58	14.2	3.9	3.6	5.57	16.5	2.8	5.9
Manure+$CaCO_3$	6.48	8.0	1.5	5.3	5.96	10.6	3.4	3.1	5.58	12.8	2.8	4.6
NPK+$CACO_3$	6.38	3.8	1.0	3.8	5.75	14.2	4.0	3.5	5.52	12.2	2.8	4.3
Manure+NPK	6.22	9.5	1.8	5.3	5.70	18.9	5.5	3.4	5.50	15.2	2.8	5.4
Manure +NPK+$CaCO_3$	6.30	7.6	1.4	5.4	5.82	16.2	3.7	4.4	5.63	13.5	2.8	4.8

Witness-0= without fertilization; NPK=N-120; P-100; K-80; Kg/ha a.s.

Table 2

The effect of loosening and fertilization on the maize harvest in preluvosoil conditions from Oradea

B. Fertilization	A. The soil loosening			The fertilization average q/ha	The difference	
	PP .3-30 plough	Chisel	MAS 60		q/ha	%
	q/ha					
Witness -0	24.5	27.8	28.9	27.1	-	-
$CaCO_3$-5 t/ha	28.6	32.6	34.3	31.8	4.7	17
Manure-50t/ha	31.4	36.0	37.6	35.0	7.9	29
N120 P100 K80 kg/ha a.s	33.1	38.1	39.8	37.0	9.9	36
$CaCO_3$+Manure	33.9	39.0	40.7	37.9	10.8	40
$CaCO_3$+NPK	36.3	41.8	43.6	40.6	13.5	50
Manure+NPK	38.5	44.2	46.2	43.0	15.9	59
Manure+NPK+$CaCO_3$	41.5	47.7	49.8	46.3	19.2	71
Loosening average-q/ha	33.5	38.4	40.1			
The difference –q/ha	-	4.9	6.6			
%	-	15	20			

DL	5%	1%	0.1%
A	2.0	3.0	4.8
B	3.2	4.2	5.5
AXB	5.4	7.2	9.3
BXA	5.5	7.3	9.7

CONCLUSIONS

1. The main chemical indices (reaction, provisioning with the most important nutritive elements)of the haplic luvisoil from Oradea indicate the absolute requirement of deep loosening ,of amendment ($CaCO_3$) and fertilizers application.
2. Soil acidity is considerably decreasing on the depth of the ploughed layer, at the singular application of $CaCO_3$ or associated with manure.
3. The application of nitrogen fertilizers improves the stage of provisioning the soil with this element and the deep loosening, encouraging the nitrification processes from soil increases meaningfully the value of the ratio from the nitric nitrogen and ammonium one.
4. The deep loosening of the soil had influenced the obtaining of some very meaningful increases of 15-20% at maize, the best results being obtained at the loosening with MAS 60.
5. The amendment with $CaCO_3$ on loosening, has increased the maize harvest on an average of 17%,the manure with 29% and the mineral fertilizers with 36%. The association of loosening with organic fertilization increases the manure effect with 11%, of mineral fertilizers with 14% and of the combination manure plus mineral fertilizers with 12%.

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