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## LYSIMETRIC RESEARCH IN ASSESSING OF CHEMICAL RECLAMATION OF SOIL AND INOCULATION OF SEEDS

*In the result of lysimetric research was studied the effectiveness of chemical reclamation of soil for growing corn for grain in the permanent crops, as with unilateral introduction of the calcium material in the form of defecate, and when combined with the drug Biogran inoculation. Found that the loss of nutrients, the highest liming  $\text{CaCO}_3$  in full hydrolytic acidity. The regularity characteristic migration beyond the root-containing layer of nitrogen and calcium soil under the influence of different calxing doses of  $\text{CaCO}_3$ .*

**Keywords:** sod-podzolic soils, calcium material, Biohran, lysimetric research, biogenic elements

**Introduction.** The solution of the theoretical and practical problems of modern agriculture is associated with the creation of optimal conditions for air and mineral nutrition of plants, which in turn is determined by soil acidity, rational use of soil moisture and nutrients.

In the zonal aspect it is important to have science-based positions on the nutrient balance in the "soil-plant" system to develop agricultural methods aimed on the effective management of used fertilizers, chemical meliorants and biologization farming tools to obtain high and stable crop productivity in sufficiently rational energy efficiency of any technology: intensive, biological, traditional and alternative.

In general, the Chernihiv region's sod- podzol soils occupy 432.5 hectares or 30 % of the arable land. The humus content in sod- podzol soils ranges from 1.16 to 1.80 %, accounting the average 1.40 %. They are mainly weakly acid and acid soil reaction of soil solution, weighted average pHsol 5,2 – 4,8. Provision of mobile forms of phosphorus - increased 111 -140 mg / kg soil exchangeable potassium - medium, 97-128 mg / kg, easily hydrolyzed nitrogen - low, 20-60 mg / kg soil. They are characterized by a low content of metabolic forms of calcium and magnesium, respectively 3, 2 - 4,1 and 0,6-0,7 mh-ekv/100 g soil, according to the agrochemical examination [6].

Increase of soil fertility of the sod- podzol type with raised acidity is not possible without a chemical reclamation [1, 2, 3]. The staff's recent researches of the Institute of bioenergy crops and sugar beet NAAS showed a significant role of calcic meliorants in the accumulation and transformation of humus substances of gray forest soils and black earth [4, 5], indicating the relevance of this issue to preserve and increase the effective potential fertility of soil. It is also important to note that one of the important conditions of a stable action of biological products should be regarded as the optimization of soil acidity. However, the limestoning of sod- podzol soils provides the contribution of 3-4 tons of calcic materials per the hectare of arable land, which is a costly farming measure.

*The purpose of this publication* is to present the results of lysimetric researches that can justify the low-cost and saving technologies of chemical soil reclamation of sod- podzol type and improve the efficiency of inoculation.

**Materials and methods.** Investigations were carried out at the left bank Polissya of the Chernihiv region with the help of stationary lysimetric installation of Institute of Agricultural Microbiology and agricultural production NAAS during 2009-2013 with hybrid maize frame, inoculation is permanent during 5 years.

Stationary lysimetric research is laid on sod - podzol medium- cultivated sandy soil that was formed on stratified water-glacial sediments. The morphological features characterized by the following features of specific genetic horizons of the soil profile:

**HE** (0-23 cm) humus (arable); unstable sandy gray lumpy, well-defined, the transition is seen.

**E** (24-38 cm) eluvial (podzol); whitish, well-defined, lumpy with a clearly defined structure plate, the transition is sharp.

**I** (39-75 cm) Illuvial; brown with reddish swelling of colloids, knitting with nut-prismatic structure, well illuvialled.

**Ip**(76-113 cm) transitional; pale-brown heterogeneous granulometric composition, well marked swelling of colloids, often molehill, the transition well defined.

**P**(114-155 cm) bedrock; water-ice sandy deposits yellow-fawn colour.

For granulometric composition the soil components of sod- podzol soils of the area are sandy and sandy loam light.

Lysimetric equipment was built in 1971-1972 by the individual project of Chernihiv Branch of the Institute Hidrotyvilprombudu according to methodological guidelines of B.A. Holubyev, E.F Arinushkina [7, 8, 9].

Lysimetric equipment has 48 lysimeter-sections, placed in two parallel rows of 24 lysimeter each.

Underneath the vessel receivers are placed to collect the filtrate. By the construction the lysimeters are concrete of a poured type.

Lysimetric cells are filled with soil series ranging from bedrock considering the power of genetic horizons.

The sown area lysimetric cell is 3,8 m<sup>2</sup>, repetition - four times a day. One cell layer of soil - 155 cm, its weight - 10.5 t. The soil of lysimetric experiment is sod- podzol loam typical of the region with such agrochemical characteristics of topsoil (0-23 cm): humus content by Tyurin – 1,1%, pH salt extract – 5,0, hydrolytic acidity ( by Kapen ) – 2,5 meq. per 100 g, P<sub>2</sub> O<sub>5</sub> content (by Kirsanov ) – 170,0 , K<sub>2</sub> O ( by Maslova ) – 62,0 mg per 1 kg of soil.

The filtrate (lysimetric water) were analyzed by the method of E.F. Arinushkinoy [7].

Scheme of the experiment:

1. Mineral fertilization system – basis N<sub>120</sub>P<sub>80</sub>K<sub>120</sub>
2. Basis + CaCO<sub>3</sub> за 1 г.к. (2, 8 t/he)
3. Basis + CaCO<sub>3</sub> за 1/2 г.к.
4. Basis + CaCO<sub>3</sub> за 1/4 г.к.
5. Basis + CaCO<sub>3</sub> за 1/4 г.к. in a year

Calcium material was brought as a defecat; the scheme of the experiment involves the study of the efficiency of reclamation as in one-sided (basis -I) and in combination with inoculation of maize seeds (basis -II) Biohran medicine . Biohran - drug complex of fertilizing action which is made on the basis of *Azospirillum brasilense*, 410, whose cells immobilized in biohumus granules produced by special technology, which provides increased synthesis of grows stimulant substances [10].

**Results and discussion.** The studies found: limestoning resulted in an increase corn capacity by an average of 5 years from 7,40 to 8,20 t/he, namely to 0.8 t/he in making calcium complete hydrolytic acidity ( var. 1 and 2 table 1). As the dose of calcium was reduced twice (var. 3 versus var. 2) marked the tendency of decrease of plant productivity 0.2 t / he, and dose reduction to 4 times (var. 4) reduction in yield was 0.6 t/he. Moreover, when making one-off meliorant the rate by ¼ g.k. mathematically accurate increments were obtained in experiments during the first three years.

Thus, when the chemical reclamation of soil growing corn in permanent crops is expedient introduction defecat dose at a rate of 2,8-1,4 t/heCaCO<sub>3</sub> (1/2-1/4 г.k ), if the criteria assess the effectiveness of using harvest data. With putting calcium per ¼ g.k.in a year, the level of maize productivity was 8,02 t/he (var. 5 table 1), at the level of variants 2 and 3, so this way of reclamation in permanent maize crops should be considered optimal.

Table 1

**Productivity of maize in a permanent seeding at chemical reclamation and seed inoculation**

№ var.	Variant	Basis I- without inoculation			Basis II – inoculation with Biohran			
		Crop capacity, t/he	in % to basis	Increase from calx	Crop capacity, t/he	in % to basis	Increase from calx	Increase from inoculation
1	Mineral fertilization system –basis N <sub>120</sub> P <sub>80</sub> K <sub>120</sub>	7,40	100	-	7,80	100	-	0,40
2	Basis+CaCO <sub>3</sub> per 1 g.k.	8,20	111	0,8	8,60	110	0,8	0,40
3	Basis+CaCO <sub>3</sub> per 1/2 g.k. (2,8 t/he)	8,00	108	0,6	8,92	114	1,12	0,92
4	Basis+CaCO <sub>3</sub> per 1/4 g.k.	7,60	103	0,2	8,48	109	0,68	0,88
5	Basis+CaCO <sub>3</sub> per 1/4 g.k. in a year	8,02	108	0,6	8,90	114	1,10	0,88
	HIP <sub>0,5</sub> T/ra	0,26			0,29			

According to basis of seeds inoculation with Biohran (basis- II) the highest plant productivity obtained by using low doses of calcium ( var. 3 and 5) at 8,9 t/he , that is higher than control at 1,1 t / he and slightly higher than variant with a full dose of calx (var. 2).

Table 2

**Loss of nutrients on variations of the experiment, kg / he**

№ var.	Basis I					Basis II				
	NO <sub>3</sub> <sup>-</sup>	CaO	MgO	P <sub>2</sub> O <sub>5</sub>	K <sub>2</sub> O	NO <sub>3</sub> <sup>-</sup>	CaO	MgO	P <sub>2</sub> O <sub>5</sub>	K <sub>2</sub> O
1	70,0	76,0	24,0	4,8	6,4	64,0	72,0	18,0	4,0	5,6
2	128,1	210,0	42,0	6,2	3,6	114,0	192,0	34,0	5,6	3,4
3	92,0	140,1	30,1	6,0	4,0	84,1	135,0	24,5	5,0	3,4
4	80,1	92,2	28,4	5,0	4,2	70,1	71,1	20,5	5,0	3,4
5	84,0	102,0	29,0	5,4	4,0	72,0	94,0	20,8	5,4	3,5
HIP <sub>0,99</sub>	3,1	1,7	0,6	0,02	0,014	0,8	0,7	0,2	0,04	0,01

Thus, the combination of calx-containing materials in dose of ¼ g.k. combined with Biohran in conditions of the experiment was as effective as one-time in (every 5 years), and the periodic use of meliorant (one year).

Loss of nutrients according to basis (var. 1), in particular nitrogen, dramatically increased (by 68 %) when putting defecat at full dose of hydrolytic acidity (CaCO<sub>3</sub> 2,8 t / he) and was below 63% dose reduction of calcium in 4 times (table 2, var. 4). The observed pattern is also characteristic of migration beyond the root layer of calcium: under the influence of calxing in complete loss of its dose increased 3 times in making CaCO<sub>3</sub> ½ by g.k. – in 2 times, and at low doses of meliorant - 34 - 21%. So, in terms of resource preservation, putting CaCO<sub>3</sub> in growing corn in permanent crops is not feasible.

Inoculation of maize seeds with Biohran demonstrated a positive impact on reducing the loss of almost all nutrients (table 2, basis II)

**Conclusions.**

1. When growing corn on sod-podzol soils, it is advisable to make calcium materials 1/2-1/4 g.k doses ( 1,4-0,7 t / he in terms of CaCO<sub>3</sub> ).

2. Inoculation of seeds with Biohranis more effective in putting small doses of CaCO<sub>3</sub>, preferably periodically - 0.7 t / he a year.

3. Losses of nutrients are the highest during calxing with dose of CaCO<sub>3</sub> at full hydrolytic acidity.

4. Inoculation of maize seeds with Biohran in conjunction with the introduction of small doses of defecat ensures the highest effect of increasing plant productivity and a significant resource by reducing the loss of nutrients beyond the root layer of soil.

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### Анотація

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**Лізиметричні дослідження при оцінці хімічної меліорації ґрунтів та інокуляції насіння**

*В результаті лізиметричних досліджень, вивчено ефективність хімічної меліорації ґрунту при вирощуванні кукурудзи на зерно в беззмінних посівах, як при односторонньому внесенні кальційвмісного матеріалу у вигляді дефекату, так і при поєднанні з інокуляцією препаратом Біогран. Встановлено, що втрати біогенних елементів найбільш високі при вапнуванні  $\text{CaCO}_3$  по повній гідролітичній кислотності. Виявлена закономірність характерна для міграції за межі кореневмісного шару ґрунту азоту і кальцію під дією вапнування різних доз  $\text{CaCO}_3$ .*

**Ключові слова:** дерново-підзолисті ґрунти, кальційвмісні матеріали, Біогран, лізиметричні дослідження, біогенні елементи

### Аннотация

**Чмель Е.П., Мильютенко Т.Б.**

**Лизиметрические исследования при оценке химической мелиорации почв и инокуляции зерна кукурузы**

*В результате лизиметрических исследований, изучена эффективность химической мелиорации почвы при выращивании кукурузы на зерно в бессменных посевах, как при*

*одностороннем внесении кальцийсодержащего материала в виде дефеката, так и при сочетании с инокуляцией препаратом Биогран. Установлено, что потери биогенных элементов наиболее высокие при известковании  $\text{CaCO}_3$  по полной гидролитической кислотности. Выявлена закономерность характерная для миграции за пределы корнесодержащего слоя почвы азота и кальция под действием известкования разными дозами  $\text{CaCO}_3$ .*

**Ключевые слова:** *дерново-подзолистые почвы, кальцийсодержащие материалы, Биогран, лизиметрические исследования, биогенные элементы*