

Application of organic-and-mineral fertilizers on grey wood surface gleyed soils of Carpathian region

The purpose. To study comparative influence of different organic and organic-and-mineral fertilizers upon fertility of grey wood surface gleyed soils.

Methods. Field, agrochemical, mathematical-statistical, method of economic evaluation.

Results. Outcomes of probes of influence of different organic and organic-and-mineral fertilizers upon physical-and-chemical, agrochemical properties of grey wood surface gleyed soil are given, as well as productivity of crop rotation, and economic feasibility is justified of their use in farming agriculture of the region.

Conclusions. Application of organic-and-mineral fertilizer Ecobiom in a dose of 1,75 t/hectare of crop rotation square improves nutritive regimen, processes of humification and ensures productivity of crop rotation at the level of 4,9 t/hectare of grain units.

Key words: organic-and-mineral fertilizers, dung, soil, fertility, humus, acidity, agrochemical properties, productivity of crop rotation.

Currently, in Ukraine's agriculture, the balance of nutrients is sharply negative due to the inability of most agricultural enterprises to apply fertilizers to the recommended standards in accordance with the technologies of growing crops. Under such conditions, the formation of crops is mainly due to the natural fertility of the soil with a decrease in the content of mobile phosphorus, exchangeable potassium and increased acidity [5, 6]. In difficult market conditions it is very difficult to implement the established approaches to reproduction of soil fertility. Therefore, all elements and technologies of agriculture should be reviewed taking into account the soil fertility and environmental safety of the environment [7, 9]. This approach is especially relevant for gray forest soils, which occupy large areas in the agriculture of the Carpathian region and are characterized by low levels of natural fertility due to unfavorable physical and chemical properties of the washing water regime. It is only possible to obtain sustainable crops on such soils only through active human intervention in wildlife, based on an integrated approach to solving the problem of increasing agricultural productivity, economic feasibility and environmental safety of agro-measures. Promising in this aspect is the involvement in the biological cycle of secondary crop production, siderates and the production of a new generation of organo-mineral bioactive fertilizers used in doses, an order of magnitude lower than the recommended ones [4]. The purpose of the research is to study the comparative influence of various types of organic and organo-mineral fertilizers (OMD) on the fertility of the gray forest surface gleyed soils of the Carpathian region and to substantiate the economic feasibility of their application. Research methodology. The influence of different types of organic and organo-mineral fertilizers on fertility indices in the arable and submarine layers of gray forest surface gleyed soil was investigated after the end of the rotation of the 4-way crop rotation (potato - spring barley with sowing of the cranberry - clover rayon - winter wheat) in the field stationary

Experiment of the Institute of Agriculture of the Carpathian region NAAS. For composting and for fertilization, straw was used for winter wheat, on sederal fertilizer - post-harvest crop of radish oil. Manure and compost were brought under the plow on the broom. In the variant with a siderate, half of the planned dose of mineral fertilizers was used for radish seedlings, the rest - under pre-sowing cultivation. In other variants mineral and OMD were introduced under pre-sowing cultivation. As OMD tested organo-mineral bioactive fertilizer eco-biom, developed in the NSC "Institute of Agriculture of NAAS", new search OMD and organo-mineral mixture (OMS), produced at the Institute of Agriculture of the Carpathian region NAAS on the basis of compost.

The soil of the experimental plot - gray forest surface gleyed medium-sandy, arable layer (0-20 cm) is characterized by such averaged baseline fertility: pNsol. - 4,57, hydrolytic acidity - 3,70 mg · ekv / 100 g of soil, the amount of absorbed bases - 5,58 mg · ekv / 100 g of soil, the content of alkaline hydrolysed nitrogen (according to Cornfield) - 86 mg / kg of soil available phosphorus (according to Chirikov) - 148, exchangeable potassium (by Chirikov) - 73.5 mg / kg of soil, humus (by Tyurin in the Nikitin modification) - 1,42%.

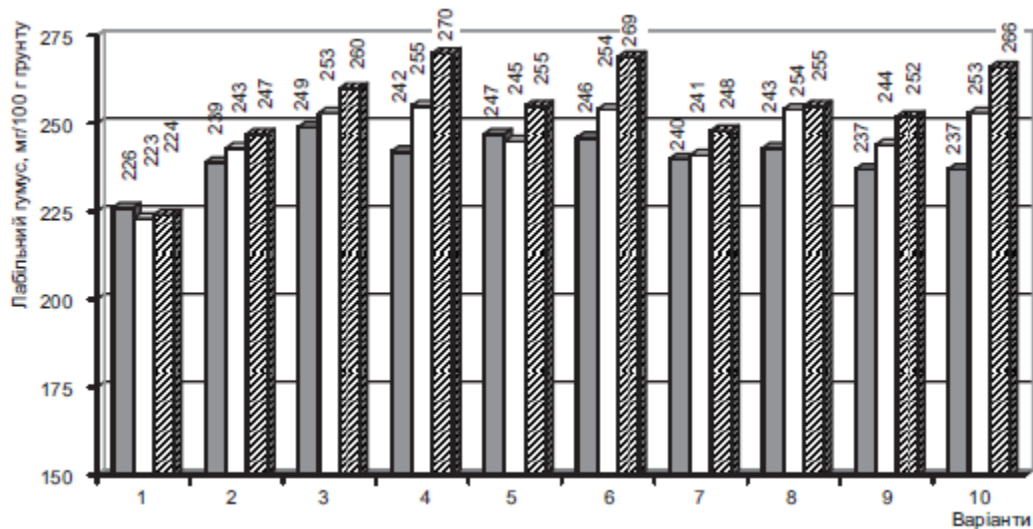
1. *Influence of various types of organo-mineral fertilizers on the physicochemical and agrochemical properties of gray forest soil (end of I rotation, 2006 - 2010).*

Варіант	Удобрення 1 га сівозмінної площі	pH _{KCl}		Сума ввібраних основ, мг-екв/100 г ґрунту		Гумус, %		Азот лужногідролізований		P ₂ O ₅		K ₂ O	
		За Чіріковим											
		мг/кг ґрунту											
		Шар ґрунту, см											
		0-20	20-35	0-20	20-35	0-20	20-35	0-20	20-35	0-20	20-35	0-20	20-35
1	Без добрив (контроль)	4,58	4,54	5,6	5,5	1,40	1,21	78,4	74,0	142	127	71	60
2	Гній, 7,5 т	4,65	4,62	5,9	5,8	1,45	1,32	91,2	78,8	156	133	76	70
3	N _{57,5} P _{57,5} K _{57,5}	4,55	4,55	5,8	5,8	1,41	1,25	93,0	79,6	168	138	89	73
4	Гній, 7,5 т + N _{57,5} P _{57,5} K _{57,5}	4,62	4,61	6,4	6,0	1,44	1,35	98,2	84,0	186	144	97	81
5	Компост, 7,5 т	4,63	4,63	5,9	5,4	1,44	1,31	93,8	78,4	151	133	75	68
6	Компост, 7,5 т + N _{57,5} P _{57,5} K _{57,5}	4,62	4,61	6,0	5,5	1,43	1,33	96,0	79,6	167	140	87	76
7	ОМС, 1,75 т	4,61	4,61	5,7	5,4	1,43	1,31	92,4	79,2	154	134	77	72
8	Сидерат + солома + N _{57,5} P _{57,5} K _{57,5}	4,64	4,62	6,0	5,8	1,44	1,34	95,4	71,6	166	138	85	76
9	ОМД, 1,75 т	4,62	4,61	5,8	5,6	1,43	1,32	94,8	61,6	156	135	88	71
10	Екобіом, 1,75 т	4,64	4,63	6,2	6,0	1,45	1,34	96,6	80,7	180	141	91	78
	НІР ₀₅	0,05	0,05	0,4	0,3	0,04	0,05	9	8	11	9	10	8

Soil samples were taken and prepared for analysis in accordance with DSTU ISO 11464: 2001. Physico-chemical and agrochemical analyzes of the soil were carried out according to the following methods: pH of the salt extract - by the potentiometric method (DSTU ISO 10390: 2001), the amount of absorbed bases according to Kappen-Gilkovits (GOST 27821: 88), the total humus content by Tyurin (GOST 26213 : 91), labile organic matter - by the method of MA Egorova with its subsequent oxidation by the Tyurin method in modification BA Nikitina (DSTU 4732: 2007), alkaline hydrolyzed nitrogen - according to Cornfield, available phosphorus and exchangeable potassium - according to Chirikov in an extract of 0.5 n CH₃ UNO (DSTU 4115: 2002). Research results. In rotation of crop rotation, in all variants, in addition to the control and variant with the removal of the mineral fertilizers itself, there was a decrease

in the acidity of the soil solution. The pH of the salt extract increased to 4.62 - 4.65 units. In comparison with the results obtained before the experiment was laid (Table 1). In the organo-mineral system fertilizer with the combined removal of mineral fertilizers against the background of manure, the use of siderates and straw and eco-bios had the most positive effect on the amount of absorbed bases, which increased to 6.2 - 6.4 against 5.58 mg ekv / 100 g of soil before laying the test. Similar patterns are established for the underlying layer of soil. The best nutrient regime of the soil was formed according to the organo-mineral fertilizer system with the removal of manure (7.5 t / ha) and mineral fertilizers (N_{57,5}P_{57,5}K_{57,5}). After I rotation, the content of alkaline hydrolyzed nitrogen in an arable layer of soil increased to 98.2, mobile phosphorus - 186, exchangeable potassium - to 131 mg / kg of soil. In variants where the siderate together with straw and compost was used as an organic substrate, the content of nutrients in the soil at the end of I rotation was: nitrogen - 95.4 - 96.0 mg / kg of soil, phosphorus - 166 - 167, potassium 85 - 87 mg / kg of soil. Carrying out in the crop rotation OMD eco-biome provided a fairly high content of nutrients in the arable and sub-soils of the soil. In this case, the content of alkaline hydrolyzed nitrogen in the arable soil layer is 10.6, mobile phosphorus - 32 and exchangeable potassium - 17.5 mg / kg of soil is higher than before the laying of the experiment. The integral indicator of soil fertility is the content of humus. It is in the carbon of organic matter that the potential reserves of solar energy accumulated by the soil are reflected [10]. Optimum indicators of the humus soil condition largely determine their resistance to adverse factors, provide stable fertility and productivity [2, 6]. In the conditions of experiment with the plowing of manure, siderates, straw, search OMS, OMS and ecoBium, the processes of humus formation in the underlying layer of soil are predominantly amplified; the content of humus is increased by 0.1-0.13% over the 4-way rotation, as compared to the control without fertilizers. In the arable soil layer only for the application of 7.5 t / ha manure and 1.75 t / ha crop rotation eco-biome, the humus content per rotation of crop rotation increased by 0.05% compared to the control. In other variants there was an increase in the content of humus by 0,03 - 0,04%. In assessing the quality of humus, its mobile compounds are important because the labile part of the organic matter is most susceptible to different conditions of economic use of soils and is characterized by greater hydrophilicity and higher content of functional groups. The inclusion of fresh carbon in persistent humus is very slow. That is why the data on the content of the fraction of mobile humus substances are important information on the directions of transformation of organic matter for different agricultural use of soils [4]. An increase in the amount of labile humus during the growing season of potatoes was observed in variants combined with the use of organic and mineral fertilizers, OMD and mineral fertilizers themselves. The lowest content of mobile humus compounds during the entire growing season was found in the variant without fertilizers - 223 - 226 mg / 100 g of soil. Among the fertilized areas below, these indicators were in the variant with manure - 239 - 247 mg / 100 g of soil (figure). The highest values of the content of labile humus substances at the end of the growing season - 220 and 269 mg / 100 g of soil - were recorded in combinations of use of organic and mineral fertilizers (options 4 and 6). Sufficiently significant changes in the content of moving forms of organic matter were observed in the version with the introduction of a new multicomponent organo-mineral fertilizer ecobiom. Thus, before planting potatoes, the content of labile humus was 237 mg / 100 g of soil, in the flowering period it was 253, and at the end of the vegetation, 266 mg / 100 g of soil, indicating the mobilizing effect of eco-bios on the organic matter of the soil.

This is explained primarily by the chemical composition and structure of the new fertilizer, which contains the optimal set of nutrients, has sorption, ion exchange and reclamation properties and a unique ability to reproduce the broken processes of synthesis and destruction of organic matter with the help of a specific biota contained in fertilizers [3]. The criterion for evaluating each agronomic event is the formation of the crop yields and the productivity of the crop rotation, which are clearly dependent on the fertilizer system.



Dynamics of changes in the labile humus forms of the arable (0-20 cm) layer of soil during the growing season of the potato, depending on the type of fertilization: - before planting; - during the flowering period; - before harvesting

The criterion for evaluating each agronomic event is the formation of the crop yields and the productivity of the crop rotation, which are clearly dependent on the fertilizer system. Studies have shown that the level of natural fertility of gray forest surface gleyed soil in conditions of experiment provides productivity of crop rotation of 3.57 t / ha of grain units.

2. *Influence of different kinds of organo-mineral fertilizers on productivity of crop rotation and economic efficiency (end of rotation of crop rotation)*

Варіант	Удобрення 1 га сівозмінної площі	Продуктивність сівозміни		Умовно-чистий дохід, грн/га	Окупність 1 грн затрат, грн	Рентабельність, %
		т зернових од.	т/га зернових од.			
1	Без добрив (контроль)	14,29	3,57	–	–	–
2	Гній, 7,5 т	16,52	4,13	1090	1,69	69
3	N _{57,5} P _{57,5} K _{57,5}	19,20	4,80	3341	2,26	126
4	Гній, 7,5 т + N _{57,5} P _{57,5} K _{57,5}	19,97	4,99	3401	1,80	80
5	Компост, 7,5 т	17,15	4,29	2578	2,09	110
6	Компост, 7,5 т + N _{57,5} P _{57,5} K _{57,5}	19,15	4,79	2929	1,59	59
7	ОМС, 1,75 т	17,95	4,49	3328	2,15	115
8	Сидерат + солома + N _{57,5} P _{57,5} K _{57,5}	19,86	4,97	4459	2,41	141
9	ОМД, 1,75 т	18,28	4,57	3165	2,08	108
10	Екобіом, 1,75 т	19,80	4,90	4115	2,41	141

According to the organomineral system, the fertilizer with a drop of N_{57,5}P_{57,5}K_{57,5} and 7,5 tons of manure on 1 hectare yielded the highest productivity of crop rotation - 4.99 tons / ha of grain units. (Table 2). Using organic biomass organic biomass ecobiom, the productivity of crop rotation increased by 1.33 tons compared with the control and by 0.77 tons compared with the manure removal. The use of search engine OMS and OMS provided productivity of crop rotation of 4,57 and 4,49 t / ha of grain units. According to the calculations of economic indicators, the use of organo-mineral fertilizers is more cost-effective than the use of manure in the event of its acquisition on the side. Studies have shown that the use of manure provided a contingent income of 1090 UAH, payback of 1 UAH - 1.69 and

profitability rate - 69% (Table 2). The combination of application of siderates, straw and mineral fertilizers and the use of organic biomass fertilizers is economically most effective on the gray forest soil for the organomineral fertilizer system. The use of these fertilizer systems obtained the highest indexes of contingent income - 4459 and 4115 UAH / ha, and payback of 1 UAH of costs - 2.41 UAH at the profitability level of 141%. In variants with the use of developed organo-mineral fertilizers and mixtures at the expense of reduction of fertilizer costs, the conventional income was 3165 and 3328 UAH / ha respectively, the payback of UAH 1, 2.08 and 2.15, and the profitability level - 108 and 115% .

Conclusions

According to the results of the research, it was established that in the conditions of the Carpathian region with the use of new organo-mineral polycomponent fertilizer ecobiom at a dose of 1.75 t / ha of crop rotation area at the end of rotation of rotation of crop rotation, the soil solution (pHCCI) of the arable layer increased to 4.64, the sum absorbed bases - up to 6.2 mg ekv / 100 g of soil, improves nutritional status, reveals a mobilizing effect on the organic matter of gray forest surface gleyed soil, which provides productivity of crop rotation at 4.90 t / ha of grain units. With the use of compost (artificial manure) at a dose of 7.5 t / ha of crop rotation, a positive tendency to increase the humus content is maintained, the acid-base, agrochemical properties of the gray forest surface gleyed soil are improved and productivity of 1 ha of crop rotation area is formed at level 4 , 29 - 4,57 grain units.

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