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CONDITION OF SOM IN LIGHT LOAM TYPICAL CHERNOZEMS OF THE RIGHT-BANK FOREST-STEPPE ZONE OF UKRAINE

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In light loam typical Chernozem (Mollisol), under different plant associations, the changes in SOM condition have been studied. Long fellow and a shelterbelt were found the most effective I the formation of soil humus and its accumulation.
Typical Chernozem, humus, shelterbelt, soil organic matter, soil humus formation, straw, farm matter, plant residues.

Introduction. Soil productivity is a great extent determined by the condition of soil organic matter, which affects essential soil regimes, and play a constructive role in soil formation and plant nutrition. The role of different humus components in these processes is not the same, as they possess different properties [5].

Man's agricultural activity modifies the natural processes of soil humus formation and accumulation, amount and quality of organic residues and remains, as well as intensity and direction of humification [1]. Many researches demonstrated the reduction of SOM in virgin soils after their introduction into agriculture, as a results of more intensive mineralization, so that after 50-60 years of cultivation such soils change their high OM condition to low and even very low. Soil tillage censes intensive mixing of organic residues with excessively loosened surface layer of the soil. This causes changes in water, air, thermal, light, and nutritive soil regimes, which, in its turn, increases soil microbiological activity. To add, a great amount of nutrient elements is taken out of the soil with crop yields, being only partly compensated by fertilizer application. But the essential cause of SOM reduction lies in the fact that a considerably smaller amount of organic residues is left in the field every year, compared with natural ecosystem.

Thus, 65-years of plow land on typical Chernozem, and its employment in a crop rotation wish interfiled crops, caused a drastic reduction in SOM concentration, especially in the surface layer of humuso-accumulative (A) horizon. In lower layers (10-30cm), the reduction of SOM was less pronounced, still remaining quite considerable. Only in 40-50 cm layer of the soil, the total concentration of SOM remained almost the same with the virgin soil's concentration,

With the passage of time, the intensity of soil humus mineralization becomes weaker, and after 70-80 years of agriculture, a period begins, when the processes of humus decomposition are compensated by the processes of its formation (humification), and SOM condition becomes stable.

Vegetation, grown in the soil, is a potent agent of SOM formation. When the soil is withdrawn from cultivation, the processes of self-region take place caused by the transformation of vegetation from agricultural crops to successive natural associations. Plant residues accumulate in the soil and on its surface, SOM balance becomes positive.

In zonal aspect, every soil type is characterized with a definite soil horizon composition as well as definite parameters of intensity and amount of SOM accumulation in soil profile.

According to research evidence [3], there are certain regularities of humus content in different soil types. The effects of plants on soil formation can be estimated by the coefficient of humus accumulation in soil profile (КПНГ in Ukrainian abbreviation), which is a ratio of SOM content and physical clay (<0.01mm) content in soil profile. Another parameter (КВАГ in Ukrainian), the coefficient of relative humus accumulation in 0-30-cm-layer of the soil, reflects the intensity of humus accumulation in every soil type.

Objects, Methods, and Conditions of Research. Our research activities were carried out in the right-bank (relative to the Dnieper) Forest-Steppe zone of Ukraine, on Typical light-loam Chernozem of the research plot of the Department of Soil Science and soil conservation under different agrocaenoses wish the application of the fallowing fertilizing variants: (a) farm manure (FM)+$N_{55}P_{45}K_{45}$ and (b) straw (1.2 $t \cdot ha^{-1}$)+N_{12} + green manure crop + $N_{78}P_{68}K_{68}$, all rates being given for a hectare of a crop rotation per year. Research variants also included the soil (typical Chernozem) of a long fallow, overgrown mainly with needle grass and couch grass associations, and the soil (typical Chernozem) under a shelterbelt (oak).

Results and Discussion. Vegetation is the most significant source of SOM. It mobilizes and accumulates the stock of potential energy and biogenic elements in above- and belowground parts [4]. SOM content under different plant association is,

therefore, different. The highest values were characterizers of typical Chernizem under shelterbelt (3.67% in surface layer). Trees reduce evaporation of water from soil surface and create optimal conditions of moisture and temperature for the humification processes. At the same time, the deep placement of tree roots favors the supply of plant nutrients and organic residues to certain depth, which intensities the processes of soil humus formation. That is why, even in the layer below the surface one, total SOM concentration under shelterbelt was higher than under the other objects of research.

On test variant with FM application, SOM concentration was somewhat higher than on long fallow variant, being equal to 3.69%, as FM enriches the soil with semi decomposed OM rich in nitrogen and possessing a higher humification coefficient. Straw, in comparison with FM, even with the green manure crop (variant 6) effected the accumulation of SOM somewhat lower, than FM (3.31%), but present-day farming practices, allowing even such levels of SOM accumulation, are quite acceptable. According to the parameters of SOM condition, proposed by Grishina and Orlov, under different vegetation, generally, the stocks of SOM were estimated as low.

The stocks of SOM in 0-20 and 0-100 cm layers did not significantly differ on our research variants and should be evaluated as low.

According to research results, the highest SOM concentration has been observed under a shelterbelt (4.52%), as in this case a considerable amount of organic matter comes comes to the soil from the forest litter and annual dying-off of tree roots, particularly the smaller ones.

Long fallow variants accumulated more OM then the crop fields, in all soil horizons under observation, as agricultural use of the soil is fraught with crop yields, and, to add, the roots of agricultural crops do not branch intensively in soil, as compared with grass roots.

There is yet another index of soil OM condition evaluation – the soil potential ability to accumulate humus. It is a difference between total soil organic carbon (SOC) content and soil humus carbon (SHC) content. The accumulation of humus in the soil is possible only if this parameter exceeds 0.5[6]. All our research objects

showed favorable conditions for humus accumulation in the upper portion of a soil profile. The greates value of value of this parameter has been found for the long fallow variants (0.9). The use of straw us organic manure slightly reduces humification, but the potential ability of the soil for humus accumulation increases.

Condition of SOM in light loam typical chernozems of the Right-Bank Forest-Steppe Zone of Ukraine

Parameters	Plant Assosiations								
	Plow land			Long fallow (grasses)			Shelterbelt (oak)		
	H	Hpk	PHk	H	Hpk	PHk	H(e)	Hp(i)	PH(k)
SOM, %	3,69* / 3,31	2,74 / 2,65	1,52 / 1,51	3,41	2,55	1,60	3,76	2,92	1,40
SOM Stock 0-20/0-100 cm, t·ha	94,8 / 316,9 / 92,6 / 270,9			94,3/333,3			88,8/296,2		
Total SOM content, %	4,25 / 4,14	2,92 / 2,79	1,65 / 1,62	4,31	2,92	1,68	4,52	3,54	1,49
Potential soil Abiliting to Humus Accumulation	0,56 / 0,83	0,18 / 0,14	0,13 / 0,11	0,9	0,37	0,08	0,76	0,62	0,09
Energy Accumulated in Humus mln kcal	1265,2 / 1129,9	420,8 / 393,7	406,0 / 406,6	1330,3	543,4	446,8	559,1	566,5	615,2
Soil Profile Humus Accumulation Coefficient (КПНГ) 0-100 cm	0,08 / 0,09			0,08			0,09		
Relative Humus Accumulation Coefficient (КВАГ) 0-30см	1,64 / 1,59			1,52			1,50		

*Nominator: FM, 40 t·ha^{-1} + $N_{55}P_{45}K_{45}$

Denominator: straw (1.2 t·ha^{-1})+N_{12} + green manure crop + $N_{78}P_{68}K_{68}$.

The amount of energy accumulated in soil humus is much lower on shelterbelt variant, as the horizon of soil accumulation under a shelterbelt is much thinner. The greatest amount of energy in soil profile was characterize if a long fallow, being equal to 2320 min kcal.

Comparing the КПНГ and КВАГ parameters, we found that on all our variants they were sufficiently high and corresponding to those of typical Chernozem [3], while practically not depending on the character of vegetative cover.

The processes of podzolization under oak plantings were very weak, which explains a quiet high profile OM accumulation coefficient exceeding those for podzolized Chernozem by 0.02-0.04.

Intensity of humus accumulation coefficient in 0-30 cm soil layer on the variants with FM application proved higher by 0.07-0.12 units than on long fallow and shelterbelt respectively.

Condusion: The greatest content of humus and soil organic matter was observed in typical Chernozem under a shelterbelt, but soil humus stock in 0-20 cm soil layer was higher with FM application, whereas in 0-100 cm layer, it was the highest on the long fallow. Soil with drawal from the plow lend for the use as a grassland, favors the potential ability of the soil to accumulate humus, decreasing though the amount of energy accumulated in soil humus.

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