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Agrophysical aspects of regulation of technological load on an instance of meadow-chernozem soil

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The purpose. To assess nature of soil after long-term agrarian use on the basis of agrophysical parameters. **Methods.** General scientific: comparative, analytical, laboratory: structural-aggregate composition of soil was determined by method of dry screening according to Savvinov; water-resistance of aggregates — according to Baksheyev; microaggregation analysis. Researches were carried out in long field stationary experience of O. Dushechkin's faculty of agrochemistry and quality of produce of plant growing which was started in 1961 in «Agronomic exploratory station» of NUBNM of Ukraine. **Results.** Changes in structural-aggregation and microaggregation content of meadow-chernozem soil were studied at its use during 60 years in 10-field crop rotation in comparison with virgin land. The highest content of aggregates (more than 1 mm) was registered for virgin land: 70,6 – 78,1% in 0 – 40 cm layer; a little lower - in alternative with fertilization of clover (61,8 – 80,5%), and the lowest — at growing sugar beet at one-and-a-half norm of fertilizer (60,0 – 74,1%). Structure factor varied analogously. Aggregation factor for clover field at one-and-a-half norm of fertilizer essentially improved and made 0,914 – 0,974 in 0 – 40 cm layer of soil. Average diameter of corpuscles augmented downwards the profile of meadow-chernozem soil. **Conclusions.** It was determined that importation of one-and-a-half dose of complete fertilizer resulted in aggravation of water-resistance of aggregates: content of water-resistant aggregates in alternative with fertilization under sugar beet made 75 – 85,9%, in alternative without fertilizers — 80,3 – 84,5%. At presence of clover field in 10-field crop rotation there was no radical aggravation of meadow-CHERNOZEM SOIL in comparison with virgin land. Gradual aggravation of its structure was observed. But use of clover field in alternative with 1,5 dose of fertilizer under crops of 10-field crop rotation improved soil structure.

Key words: *agrophysical degradation, structure of soil, water-resistance of aggregates, crop rotation, meadow--chernozem soil.*

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Introduction. In modern conditions of agriculture scientists and farmers pay attention to the increasing scale manifestation of such negative phenomena as spraying the soil structure loss, compaction, emergence of plow soles and other dangerous manifestations agrophysical degradation. The main objective should be not to eliminate the negative effects of this type of degradation, and its early detection and prohnozuvannya dangerous consequences.

Analysis of recent publication. At the present stage, in the agricultural production of Ukraine, there have been radical social-economic transformations that have led to the introduction of new forms of management based on the principles of private ownership of land and property, formed market-based production relations, and based on commodity- money circulation in order to maximize profits. The consequences of these changes, as well as the long extensive approach to land use, have led to the unstable state of the industry, the imbalance in the natural environment and the aggravation of social tension.

Experimental dates, which were received estify to the significant rejection of soil physical factors from the appearance of cultural plots and explain the significant fluctuations of their ecosystems with the ranks [2]. In Ukraine, there is a danger of deep irreversible soil degradation, so passive and indifferent attitude to minimizing cultivation in the country means the absence of real cases in soil protection [3]. The

increase of anthropogenic pressure on the soil leads to an increase in degradation processes at least in all areas of the earth [4].

The period of the study of black soil in the country influenced their granulometric and microreagulant glass. We are glad that the change of the granulometric glass of black soil under the influence of the soil-forming process and the agricultural culture goes back to the point of ignition. In the study of this nature, it is not necessary to interfere with the investigation of the quantization of the number of microorganisms or microorganisms without giving rise to changes in their quality [5].

In developed countries, a high culture of land use involves not only the intensive use of soils, but also the mandatory adoption of measures to prevent their degradation. Instead, the use of natural soil fertility without its restoration is a sign of the low level of development as a culture of agriculture and society as a whole [4]. Stability of soil aggregates is a basic indicator of soil quality and ecological stability of agroecosystems Today, the development of soil protection principles, prevention of degradation processes and promotion of potential fertility is still topical [7].

The saturation of crop rotation with crops of continuous crops, especially herbs, stabilizes the structural composition, as a result, the content of agronomically valuable aggregates accounted for 63-68.4% for plowing, and 68.0-70.8% for flat-cut tillage; waterproof, respectively 50,6-59,3%. The structure under the wheat crops of winter and sugar beets was significantly lower [8].

The aim of **research is to estimate** agro-physical parameters of the soil under the influence of long-term agricultural use.

Research methodology. The research was conducted in the long-term field stationary experiment and the Department of Agrochemistry and the quality of plant products, founded in 1961 at the Agrarian Research Station of NULeS of Ukraine (Pshenichni village, Vasylkivskyi district, Kyiv region) [9].

Samples of soil taken from ten-years crop rotation: clover, winter wheat, sugar beet, silage corn, spring wheat, peas, winter wheat, sugar beet, maize, barley sowing of clover. In addition, simultaneously in the form of protective bands laid down as absolute control. The structural and aggregate composition of the soil was determined by the method from the ear sowing by Savinov; water resistance of aggregates – by Baksheyev. The coefficient of structurality was calculated as the ratio of the sum of aggregates in the size of 0.25-7 mm to the sum of aggregates less than 0,25 mm and more than 7 mm.

The results of scattering of dry soil samples are presented in Tables 1.

Table 1 Results of the structural-aggregate composition of meadow-chernozem soils VP NUBiP Ukraine "Agronomic Experimental Station" (dry sifting)

Culture	Fertilizer option	Depth of sampling of soil, see	Structural aggregate content,%			To the structural factor
			> 1mm	<0.25mm	> 7mm	
Sugar beets	Control (no fertilizer)	0-10	72.3	3.97	24.8	4.20
		10-20	66.8	11.7	21.0	3.34
		20-30	71.1	6.8	17.0	4.63
		30-40	73.8	5.7	10.5	6.47
Sugar beets	NPK 1.0	0-10	70.5	9.3	22.9	3.53
		10-20	66.9	12.7	15.9	3.61
		20-30	68.3	10.9	18.3	3.68
		30-40	77.2	5.2	20.0	4.56
Sugar beets	NPK 1.5	0-10	60.0	15.3	19.4	3.00
		10-20	69.5	11.4	21.9	3.32
		20-30	74.1	7.0	27.2	3.51

		30-40	68.6	11.9	16.3	3.70
Fallow		0-10	72.3	14.8	12.9	3.54
		10-20	76.7	7.4	18.1	4.34
		20-30	7 8.1	6 , 6	13.4	5.34
		30-40	70.6	7.8	16.8	4.43
Clover	Control (no fertilizer)	0-10	59.1	10.9	13.1	4.26
		10-20	74.5	7.6	19.5	4.13
		20-30	74.4	8.3	27.3	3.34
		30-40	76.1	9.5	26.3	3.26
Clover	NPK 1.5	0-10	6 1.8	1 0 9	12.6	4.33
		10-20	80.5	6.0	26.1	3.74
		20-30	77.6	6.8	2 1	4.11
		30-40	78.0	7.3	17	4.51

The highest content of aggregates more than 1 mm was observed: 70.6-78.1% in the 0-40 cm layer, somewhat lower - under the fertilized variant on the field of the clover (61.8-80.5%), and the smallest aggregate data was for cultivating beet sugar at one and a half times the fertilizer rate (60.0-74.1%).

Similar conclusions we made and on the coefficient of structure, which shows quantitative changes in the structure of structural units. The highest values were observed in flour (3.54-5.34), the smallest - 3.00-3.7 in the fertilized version of sugar beet. It should be noted that the structural coefficients significantly differed for the cultivation of clover without fertilizers (Kstr 3.26-4.26) and for the use of a half-norm of fertilizers (3.74-4.51). The research was carried out by us for plowing on the meadow-chernozem ground. However, researches [10] was defined that minimize tillage with the use of organo-mineral fertilizer system helped to increase the content of agronomically valuable aggregates and create the best conditions for aggregation of 0-30 cm humus layer model.

Water resistance of structural aggregates is one of the main agrophysical parameters, which directly affects the soil fertility and conditions of their agricultural use. Table 2 shows the data of wet screening of ground samples of stationary experiments.

Table 2. Results of wet sifting and microagregation of samples of meadow and chernozem soils VB NUBiP Ukraine "Agronomic Experimental Station"

Culture	Fertilizer option	Depth of sampling of soil, see	Content of water-proof aggregates more than 0,25 mm,%	Average - weighted particle diameter, mm	Ka *	C **
Sugar beets	Control (no fertilizer)	0-10	78.9	0.85	0.822	0.133
		10-20	81.5	0.96	0.721	0.654
		20-30	80.5	1.21	0.965	0.033
		30-40	83	1.05	0.954	0 423
Sugar beets	NPK 1.0	0-10	80.3	0.7	0.928	0,089
		10-20	85.1	0.62	0.966	0.017
		20-30	77.7	0.71	0.860	0.063
		30-40	84.5	1.05	0.844	0.167
Sugar beets	NPK 1.5	0-10	75	0.54	0.925	0.146
		10-20	80.9	0.54	0.950	0,200
		20-30	76.6	0.63	0.857	0.593

		30-40	85.9	0.97	0,867	0,767
Fallow		0-10	87.8	1.83	0.885	0.284
		10-20	89.2	2,11	0.974	0.08
		20-30	94.1	1.91	0.937	0.568
		30-40	86.5	1.59	0.921	0.585
Clover	Control (no fertilizer)	0-10	80.1	0.72	0.915	0.600
		10-20	86.0	1.62	0.713	0.89 9
		20-30	89.6	1.39	0.768	1,456
		30-40	92.1	1.92	0.941	0.161
Clover	NPK 1.5	0-10	92.1	0.66	0.914	1.242
		10-20	80.6	1.0	0.940	0.158
		20-30	86.3	1.36	0.974	0.064
		30-40	87.8	1.17	0.963	0.032

* Ka - Coefficient of aggregation Beaver and Roathers

* C - content of unaggregated elementary soil particles (MF)

In agrophysics water resistance of soils is characterized by a number of indicators, but the main of them are two - the sum of water-proof aggregates more than 0,25 mm and weighted average diameter. The first is sufficiently "inert", and the second one is "sensory". In general, meadow-chernozem ground is characterized by high content of water-resistant aggregates. It was established that the administration of a half-full dose of full fertilizer leads to deterioration of water resistance of aggregates. Thus, the content of water-resistant aggregates in the fertilized version of beets was 75-85.9%, whereas in the variant without fertilizers - 80.3-84.5%. It is important that clover field significantly improves water resistance units as in fertilization and in control. The water resistance of the aggregates over 1 mm in diameter was 86.5-94.1%, where the average weighted diameter of the particles was 1.59-2.11 mm.

For the cultivation of sugar beet with the introduction of a single and one and a half norm of fertilizers, there was no critical decrease of this indicator, especially in the lower 20-30 and 30-40 cm layers of meadow-chernozem soil. The coefficient of aggregation in the field of the clover with a one-and-a-half fertilizer norm improved significantly and amounted to 0,914-0,974 in the 0-40 cm layer of soil.

Conclusions.

According to the results of researches of the structural and aggregate composition indicators, it was established that its use in the structure of 10-way crop rotation does not lead to significant negative changes. Indicators of the coefficients of structurality, the content of water-resistant aggregates, etc. on the fertilized version of the field of the clover approached the virgin land. However, crop rotation with perennial grasses is expedient and only if the livestock, which takes place in the Separated subdivision of NULES of Ukraine “Agronomic Research Station”. At the same time, short-rotation crop rotations from intensive crops (soybean, rape, corn, etc.) are used mainly in Ukraine, which is the causes of modern accelerated degradation of soils.

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