AGROECOLOGICAL STATE OF SOIL COVER OF BEREZNIVSKYI REGION RIVNE AREA

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Abstract. *The article provides ecological and agrochemical assessment of soil of Bereznivskyi region Rivne Area. It is established that prolonged heavy use of soil area resulted in a decrease of humus content in soils major area by 0.06 %, phosphorus - 2.2 mg/kg, potassium - 2.7 mg/kg of soil, compared with the previous round of the survey. The lead content in soils of the area ranges from 0.1 to 24.1 mg/kg, of cadmium - 0,01-1,93 mg / kg, zinc - 0,2-36,2 mg/kg, of copper - 0.1-17.7 mg/kg, of mercury - 0,03-0,08 mg/kg.*

Keywords: *agroecological state, soil, humus, phosphorus, potassium, cadmium, zinc, copper, mercury, agro-ecosystem*

Formulation of the problem. The problem of the protection and rational use of land, in our time, is extremely relevant, both in our country and around the world.

Constantly growing negative impact of human activity often leads to catastrophic state of the environment, which is determined primarily by the destruction and even rupture of constant interrelation in living ecosystems [1, 2].

Modern environmental and economic conditions, the energy crisis, obsolete and physically destroyed farm equipment, lack of organic fertilizers, intensive plowing of sloping land led to disruption of farming systems, increased degradation processes, soil erosion and run-off, the acidity, weed-infested and so on. In pursuit of high yields, the soil began to plow deeper and more often, being poured with huge amounts of fertilizers and pesticides. As a result, huge areas lost the ability to absorb and hold water, their structure degraded, soils became saturated with harmful chemicals [3].

Due to the extensive development of agriculture and forestry, inefficient maintenance reserve and other nature protection, area ratio of arable land disrupted natural grasslands forest and water resources and as a result - an intensive development of erosion, compaction arable soil, reducing its fertility.

Therefore, the rational use of land in agricultural development and effective application of complex measures of control and soil fertility management are not possible without understanding their actual agroecological conditions. So we are talking about a qualitative assessment of the soil at this level when you take into account not only productivity, but also contamination, heavy metals, pesticides and other toxicants [5].

In recent years, there are significant adverse changes in the quality of soil due to increased intensity of the impact of anthropogenic and technogenic factors on land resources. Unbalanced load on all categories of land has reached a level at which catastrophic consequences not only for the whole system of nature, but also for the social sector in general are possible. According to statistics, there was the tendency of worsening the quality of the fertility of land. Of particular concern is the rise in recent years of technological processes and violations of water pollution and chemical indicators of soil quality [6, 7].

Analysis of recent research. Under current conditions, reliable means of restoring sustainable agro-ecosystems functioning of Polissia area is the greening of agricultural production. In this connection it is necessary to forecast agroecological situation, improving the management of fertility and productivity of agrocenoses in specific soil and climatic and economic conditions, on the basis of a detailed assessment of agroecological soil conditions in the region.

In agricultural ecosystems, ecological balance between synthesis and decomposition of organic matter, which led to the deterioration of nutrient, water, air and other modes of soils is deteriorated. The greatest danger for soil cover of Polissia are the processes of dehumification and decalcification, the intensity of which is increasing annually.

The impact of anthropogenic factors on physical - chemical, agrochemical and agrophysical degradation of soil Woodlands of Ukraine is studied by many scientists: V. A. Kovda, Yu. A. Zlobyn, B. M. Mirkin, G. A. Bulatkyn, V. V. Laryonov, V. V. Lisovyi, V. I. Kisel, V. V. Medvedev, R. S. Truskavets and others, but now it is still important and urgent.

Materials and methods of research. Comprehensive assessment of the state of agroecological farming of arable land is based on the analysis and synthesis of source materials, statistical data and soil-agrochemical, ecotoxicological monitoring using evidence-based criteria, standards, regulations.

Assessment of climatic conditions performed according to years of systematic observations of Rivne Hydrometeocentre, agro-climatic handbooks and technical report on the comprehensive updating soil map area.

Data processing of agrochemical certification of agricultural land of Bereznivskiy region, held in 2009, by "Oblderzhrodyuchist."

The selection of soil samples was carried out to a depth of 0 - 20 sm.

Laboratory analytical tests to determine the agrochemical properties of soils were conducted by conventional methods: humus by Turina (GOST 26213-91), pH - potentiometrically (GOST 26483-85), mobile phosphorus - by Kirsanovs (GOST 26207-84) and modified by Machyhina (ISO 4114-2002); heavy metals in soil were determined at atomic adsorption spectrometer P-115 by the ZINAO method.

Mathematical statistical analysis and results analysis were carried on "Excel" at PC [4].

Results. The reaction of soil solution plays an important role in the development of plants and soil microorganisms, affects the speed and direction of motion in its chemical and biochemical processes. The acquisition of plants batteries, the intensity of microbial activity, mineralization of organic matter, soil degradation and dissolution of minerals of various soluble compounds, coagulation and peptization of colloids and other physical and chemical processes, determine the response of soil.

Acidic reaction of soil among the adverse environmental factors, hindering the growth and development of most crop species. Acid reaction is the characteristic of sod-podzolic and bog soils, neutral – of black. All crops are differently related to the degree of acidity of the soil, as a culture has a pH range at which it grows well and develops.

In total surveyed area of acid soils, as shown in Table 1, with pH ≤ 5,5 there 15,999.9 ha (74.5 %) of them are strongly acidic (rN≤4,5) - 5400.5 ha (25.1 %), moderately acidic (pH 4,6-5,0) - 6023.8 ha (28.0 %), slightly acidic (pH 5,1-5,5) - 4575.6 hectares (21, 3 %). Area of soils that have reaction medium is neutral (pH 5,6-6,0) is 3232.4 hectares (15.0 %). Total area of neutral soil pH of 6,1-7,0 is 2271.4 hectares (10.5 %).

Table 1. Description of land farms of Bereznivskiy region in terms of pH

Surveyed area, thousand ha	Area of soil by reaction environment											
	Very acidic <4,5		Acidic 4,1-4,5		Medium acidic 4,6-5,0		Weakly acidic 5,1-5,5		Close to neutral 5,6-6,0		Neutral 6,1-7,0	
	Thou-sand ha	%	Thou-sand ha	%	Thou-sand ha	%	Thou-sand ha	%	Thou-sand ha	%	Thou-sand ha	%
21,50	1,09	5,1	4,31	20,0	6,02	28,0	4,58	21,3	3,23	15,0	2,27	10,5

Because of harmful impact on the soil, anthropogenic and abiotic factors, technological use of soil in large parts of Ukraine lost 10-25 % of organic matter, virtually all the arable land in the subsoil layer of compacted, significantly reduced inventories of nutrient forms of phosphorus and potassium. Reduced calcium content in acid soils and thus extends unstructuring, crust formation, overcompaction of topsoil and, consequently, reduced productivity of agricultural crops.

If the trend remains the same, in the nearest future Ukraine may be on the verge of starvation humus - a major environmental disaster. And then there is no land treatment, reclamation, environmental, organizational and economic measures that can recover potential crop land.

If not to compensate ground that what is taken, it violates the basic law of agriculture - the law of return.

Table 2. Agrochemical characteristics of land by humus content, mobile phosphorus and exchange potassium preliminary rounds and final examination

Name of administrative-territorial unity	The humus content, %		Phosphorus content, mg/kg of soil		Potassium, mg / kg of soil	
	preliminary round	last round	preliminary round	last round	preliminary round	last round
Bereznivskiy region	1,76	1,70	78,2	76,0	51,7	49,0
By area	1,97	1,92	116,3	166,0	69,4	67,3

When comparing the two rounds of inspections (tab. 2), the main agrochemical indices of soil Bereznivskyi region decreased: humus by 0.06 %, phosphorus - 2.2 mg/kg, potassium - 2.7 mg/kg of soil.

If the trend remains the same, in the nearest future Ukrainian soils, as well as Bereznivskyi region may be on the verge of a major environmental disaster. And then there are no land treatment, reclamation, environmental, organizational and economic measures that can recover potential crop of land.

The current status of the soil depends on many diverse factors. The development of industrial production, transport, agriculture and municipal biosphere pollution causes various man-made compounds. A significant amount of pollutants is emitted, ultimately entering the soil, that accumulates to a much greater extent than the atmosphere and water sources. This is due to the fact that most of all the processes of mineralization of organic residues and metabolism between the Earth's crust, hydrosphere, atmosphere and living organisms are held in the soil.

In the study area (Table. 3) in 2011, an increase of pollutant emissions was seen, if compared to 2009. However, emissions in the region decreased.

The density of emissions from stationary sources of pollution per kilometer square area was 152 kg to 130.9 kg in 2009, the per capita population 4.2 and 3.6 kilograms respectively.

Table 3. Emissions of pollutants into the atmosphere from stationary sources of pollution

Administrative unit	The volume of total emissions, t.		The density of the emission kg / km^2		Per capita, kg	
	2009	2011	2009	2011	2009	2011
By area	16210,0	9971,5	808,4	497,3	14,1	8,7
Bereznivskyi region	223,7	260	130,9	152	3,6	4,2

Intensive industrialization in Ukraine, led to a problem of technogenic pollution of soils with heavy metals, including also Polissia region.

Analyzing the level of soil contamination with heavy metals (tab. 4-8), it should be noted that 99,3-100 % of surveyed soils content to 0.5 MAC.

Lead content (tab. 4) in the soils of the area ranges from 0.1 to 24.1 mg / kg, of cadmium - 0,01-1,93 mg/kg, zinc - 0,2-36,2 mg/kg, copper - 0,1-17,7 mg/kg, of mercury - 0,03-0,08 mg/kg. Soil contamination by heavy metals of MPC was not found. Tables 4-8 show the distribution area for the content of heavy metals in soils of the study area.

Table 4. Distribution of the surveyed areas of Bereznivskiy region farmland for lead content

Surveyed area, thous. ha	Distribution of the levels of pollution, thous. ha					
	Up to 5,0 mg/kg	5,1-10,0 mg/kg	10,1-15,0 mg/kg	15,1-20,0 mg/kg	20,1-25,0 mg/kg	More than 25,0 mg/kg
10,598	6,003	4,145	0,372	-	0,078	-

In the area of soils of 6.003 thousand ha, a low level of lead is observed. In this area its concentration is up to 5.0 mg / kg of soil. Only 78 ha of its concentration reaches more than 20.1 mg / kg.

Table 5. Distribution of the surveyed areas of Bereznivskiy region farmland for cadmium content

Surveyed area, thous. ha	Distribution of the levels of pollution, thous. ha					
	Up to 0,20 mg/kg	0,21-0,50 mg/kg	0,51-1,0 mg/kg	1,01-1,50 mg/kg	1,51-2,0 mg/kg	More than 2,0 mg/kg
10,598	7,524	2,665	0,409	-	-	-

Minor content of cadmium (0.2 mg / kg) was observed at 7.524 thousand ha, and high (0,51-1,0 mg/kg) - only at 409 ha of (tab. 5).

Table 6. Distribution of the surveyed areas of Bereznivskiy region farmland for copper content

Surveyed area, thous. ha	Distribution of the levels of pollution, thous. ha					
	Up to 7,0 mg/kg	7,1-14,0 mg/kg	14,1-21,0 mg/kg	21,1-28,0 mg/kg	28,1-35,0 mg/kg	More than 35,0 mg/kg
10,598	10,284	0,314	-	-	-	-

In the area of soils of 10.284 ha low copper content is observed, its concentration reaches 7 mg / kg. Soils with high concentration (7,1-14mh / kg) occupy only 314 ha of ground (tab. 6).

Table 7. Distribution of the surveyed areas of Bereznivskiy region farmland for zinc content

Surveyed area, thous. ha	Distribution of the levels of pollution, thous. ha					
	Up to 16,0 mg/kg	16,1-20,0 mg/kg	20,1-40,0 mg/kg	40,1-60,0 mg/kg	60,1-80,0 mg/kg	More than 80,0 mg/kg
10,598	9,993	0,162	0,443	-	-	-

Minor zinc content (up to 16.0 mg / kg) was found in the soil at area of 9,993 ha, higher concentrations (20,1-40,0 mg / kg) on area of 443 ha (tab. 7).

Table 8. Distribution of the surveyed areas of Bereznivskiy region farmland for mercury

Surveyed area, thous. ha	Distribution of the levels of pollution, thous. ha					
	Up to 0,10 mg/kg	0,11-0,20 mg/kg	0,21-0,50 mg/kg	0,51-1,00 mg/kg	1,01-1,50 mg/kg	More than 1,50 mg/kg
5,607	5,607	-	-	-	-	-

In soils of the area low level of mercury is detected. In the area of 5.607 ha surveyed its concentration reaches 0,10 mg/kg (Table. 8).

To increase the fertility of sod-podzolic soils one should carry out activities such as fertilizing, liming, the gradual deepening of the topsoil, planting lupine fertilizer. Particularly problematic introduction of phosphate fertilizers. We recommend using phosphate flour, making local practice phosphate fertilizers. In light soils should be used as organic fertilizer and potash, very effective green manure, crop perennial grasses. Among organic fertilizers the preference should be given to peat compost manure.

The complex measures for culturing leads to the predominance of humic-accumulative process, improve the quality of humus, increase of NRA.

In sandy loam and sod-podzolic loamy soils it is needed to add 50-60 t/ha of organic fertilizer in the fall or during a previous culture. Soluble fertilizers, the active ingredient which is not absorbed by the soil (especially sodium nitrate, calcium and ammonium) and is easily washed out, should be added mostly in spring and during the growing season.

Turf loam soils used in field crop rotations and for improving grasslands. They spend flaky stubble, autumn plowing with a depth of 22 - 25 sm. Adding fertilizers. Need to add pure lime up to 3.5 t/ha and drainage of excess of moisture.

Meadow marsh, mud bog and peat bog soils require radical improvement through the rapid meadow. Drainage, making lime 4.5 - 5.0 t/ha and active ingredient is needed. To use as grasslands.

In the lowland peatlands drained and poorly decomposed, water regime is needed. Radical improvements by introducing phosphorus-potassium fertilizer. To use as grasslands.

To restore the fertility of acid soils and getting stable yields of crops, chemical reclamation of acidic and second acidified soils is recommended. For traditional technologies of amelioration of acid soils that prevailed in Ukraine during the large-scale reclamation, on slightly acidic soils, add 3.4 tons of lime per 1 ha and on medium sour - 5.6 t / ha, separately on the soil surface with further plowing.

Conclusions. 1. The soil of Bereznivskiy region is represented mainly by three genetic types - sod (23772.1 ha or 39.2 %), sod-podzolic (23,029.8 hectares or 36.4 %) and marsh (9693.2 ha or 15.3 %).

2. Agricultural land area is 63,765 hectares, representing 37.2 % of the territory. The structure of agricultural land into arable land accounts for 36,821 hectares, which is 57.7 %.

3. The soils have acidic reaction: the area of soils with pH ≤ 5,5 is 15,999.9 hectares or 74.5 %. Area of soils that have reaction close to neutral (pH 5,6-6,0) is 3232.4 hectares (15.0 %). Total area of neutral soil pH of 6,1-7,0 is 2271.4 hectares (10.5 %).

4. Prolonged intensive use of soil area resulted in a decrease of humus content in soils at major area by 0.06 %, phosphorus - 2.2 mg/kg, potassium - 2.7 mg/kg of soil, compared with the previous round of the survey.

5. The lead content in the soils of the area ranges from 0.1 to 24.1 mg / kg, of cadmium - 0,01-1,93 mg/kg, zinc - 0,2-36,2 mg/kg, of copper - 0, 1-17,7 mg/kg, of mercury - 0,03-0,08 mg/kg.

Conducted environmental and agrochemical assessment of soil will be used to identify crises in agricultural land use; monitoring and predicting changes in the functioning of agricultural landscapes; expert decision-making that will be the basis for developing operational programs and long-term measures to improve the agro-ecological condition of agricultural land.

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