UDC 631.111.3(338.432:502.33)
JEL: Q150, Q240, R140

QUALITY OF SOIL IN THE SYSTEM OF AGRO ECONOMIC NATURAL USE SUPPLYING

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Received: August, 2017
Accepted: October, 2017

Introduction. The article presents the issue of improving soil quality continues needs to be urgent. In particular, the task of improving the quality of agricultural land and considering the qualitative characteristics as an object of management remains unresolved, which necessitates further systematic research in this direction.

Aim and tasks. The purpose of the article is to substantiate the essence of soil quality management, the creation of land masses with appropriate soil characteristics as a means of obtaining safe products of standardized quality, maintaining the quality of the natural environment, preventing its degradation and using innovative industrial technologies in alternative agricultural systems. The task is in the justification that qualitative soil properties and fertility are inextricably linked.

Research results. The processes of soil formation and soil fertility are determined by a number of natural factors and the nature of economic activity, which affects not only the arable layer but also deeper soil horizons, as well as groundwater and groundwater. The optimal parameters of fertility indices should be established for each type of soil, if they can vary according to the fertility patterns as a combination of soil properties and modes that ensure the productivity of the land, the high quality and safety of the agricultural products derived from them. Returning lands to their original state is not always possible, but it is necessary. The application of certain approaches and technologies of updating the qualitative state of agricultural land causes the formation of conditionally clean land masses among those who potentially can become, after a certain time, suitable for obtaining safe production products. Ecologically clean land massifs, regardless of the degree of environmental readiness for economic use, are spatially limited, artificially created territories, the peculiar feature of which is the minimal cultivation of soil, the compliance with ampeloecological and agroecological requirements of cultivating those or other crops, the presence of indicator plants regulating contamination, the remoteness from pollutants, control of all agrotechnical measures, preservation and regulation of soil fertility.

Conclusion. To achieve ecological purity is possible through a variety of activities. Land massifs with special characteristics play an important role and have a close connection with modern agrotechnologies that differ from agrotechnical measures, with a more systematic and more closely related to the microperiods of agricultural crop development. It is determined that the management of ecological agriculture will facilitate the creation of land uses with special characteristics, which are achieved through the implementation of the general laws of agriculture and a number of principles, among which the principles of environmental orientation are combined with the principles that facilitate their implementation.

Keywords: ecologically clean land massifs, soil quality, agroeconomic nature management, anthropogenic loading, humus, ecological monitoring, pollution of land.

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ЯКІСТЬ ГРУНТУ В СИСТЕМІ АГРО-ЕКОНОМІЧНОГО ПРИРОДНОГО ВИКОРИСТАННЯ

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Отримано: Август, 2017
Прийнято: Жовтень, 2017

Проблема. Питання покращення якості ґрунтів надалі залишається нагальним. Зокрема завдання підвищення якості сільськогосподарських земель та розгляд якісних характеристик як об'єкту управління залишаються до кінця невирішеним, що зумовлює необхідність проведення подальших системних досліджень в цьому напрямку.

Мета та завдання. Метою статті є обґрунтування сутності управління якістю ґрунтів, створення масивів земель з відповідними ґрунтовими характеристиками як засобу отримання безпечної продукції стандартизованої якості, підтримки якості природного середовища, запобігання його деградації та використання інноваційних індустріальних технологій в альтернативних системах сільського господарства. Завдання полягало в обґрунтуванні, що якісні властивості ґрунтів та родючість пов'язані між собою.

Результати. Процеси ґрунтоутворення та родючості ґрунту визначаються рядом природних факторів та характером господарської діяльності, яка впливає не тільки на ріллю, але й на більш глибокі горизонти ґрунтів, а також на підземні води. Оптимальні параметри показників родючості повинні встановлюватися для кожного типу ґрунту, тобто вони можуть змінюватись у відповідності до моделей родючості як сукупності ґрунтових властивостей та режимів, які забезпечують продуктивність земель, високу якість та безпеку отриманої з них сільськогосподарської продукції.

Застосування підходів та технологій оновлення якісного стану сільськогосподарських земель обумовлює формування умовно чистих земельних масивів, незалежно від ступеня їх екологічної готовності для господарського використання як просторово обмежених територій, особливістю яких є мінімальний обробіток ґрунту, відповідність агро та ампелоекологічним вимогам вирощування культур, наявність рослин-індикаторів регулюючих забрудненість, віддаленість від забруднювачів, контроль всіх агротехнічних заходів, збереження та регулювання родючості ґрунтів.

Висновки. Земельні масиви з особливим характеристиками грають важливу роль та мають тісний зв'язок із сучасними агротехнологіями, які відрізняються від агротехнічних заходів, більшою системністю і тіснішою приуроченістю до мікроперіодів розвитку сільськогосподарської культури Визначено, що управління екологічним землеробством сприятиме створенню землекористування з особливими характеристиками, що досягається шляхом реалізації загальних законів сільського господарства та ряду принципів екологічної орієнтації.

Ключові слова: екологічно чисті земельні масиви, якість ґрунту, агроекономічне природокористування, антропогенне навантаження, гумус, екологічний моніторинг, забруднення землі.

Introduction. Powerful anthropogenic loading on agricultural land leads to a change in their condition, which is accompanied by a negative balance of humus, lack of organic matter, important elements of nutrition, contamination of heavy metals, activation of degradation processes. It is especially dangerous for the most valuable and widespread Ukrainian chernozem, susceptible to man-made and anthropogenic loading.

Considering that most foodstuffs are received by mankind through economic land cultivation and more than 70% of all pollutants enter the human body with food products, the role of ecologically clean lands is updated:

- as an indispensable natural resource and a basis for the production of safe products, which does not directly or indirectly cause harmful effects on human health;

- as the basis for the formation of ecologically balanced agroecosystems that require modeling in accordance with the specialization of economic activity.

This is in line with the strategic objectives of the state policy in the field of agrarian land use, in particular, improvement of the structure of agricultural land, reproduction of its fertility and ensuring the rational use and protection of lands on the basis of ecologization [1].

Analysis of recent research. The ecological component in the problem of agro-economic nature management is investigated by the scientific collectives of the State Enterprise Institute of the Natural Resources Economics and Sustainable Development of the National Academy of Sciences of Ukraine, the NSC "Institute of Agrarian Economics", NSC "Institute of Soil Science and Agrochemistry" them. O.N. Sokolovsky Institute of Agroecology and Nature Management, Institute of Water Problems and Land Reclamation of NAAS of Ukraine, State Institute of Soil Protection of Ukraine, etc. The mentioned problems are realized in the directions: formation of institutional principles of land resources use and estimation of socio-ecological and economic efficiency of their use in the context of sustainable development of rural territories; substantiation of vectors of ecologization of agricultural land; increase of soil fertility by introducing innovations in the field of soil science and agrochemistry; the revival and development of economic activity in contaminated territories; implementation of a single scientific and technical policy in the field of soil protection and fertility; rational use and ecological safety of agricultural lands; scientific, methodological and organizational support of state monitoring of soils and agrochemical certification of agricultural lands; conducting agriculture on reclaimed lands and establishing regularities of ecological processes in these lands.

The formation of a rational system of land ownership and land use, the creation of environmentally sustainable landscapes and agro-systems remains a matter of strategic importance, the implementation of which is carried out by the State Service of Ukraine of Geodesy, Cartography and Cadastre, which is responsible, among other issues, for environmental regulation of land relations and the establishment of a special regime and conditions of use lands.

Research and design works in the field of land management, protection, assessment and rational use of land, geodesic works are carried out by scientific groups of the extensive system of institutes of land management.

Aim and tasks. The issue of improving the quality of soils continues to be urgent. In particular, the task of improving the quality of agricultural land and considering the qualitative characteristics as an object of management remains unresolved, which necessitates further systematic research in this direction. The purpose of the article is to substantiate the essence of soil quality management, the creation of land massifs with appropriate soil characteristics as a means of obtaining safe products of standardized quality, maintaining the quality of the natural environment, preventing its degradation and using innovative industrial technologies in alternative agricultural systems.

Main results. Soil quality is a set of its physical, chemical and biological properties, which have undergone significant changes due to inefficient system of economic use of lands, soil restoration and progressive degradation of agricultural landscapes. Ukrainian lands are

degraded as a result of all possible negative processes, which are accompanied by the use of agricultural land over time, namely loss of humus and nutrients, drying (desertification) and waterlogging (waterlogging), salinization and acidification, pollution by discharges, emissions, wastes, chemical means of protection plants, erosion damage. Summarizing the above-mentioned changes it can be stated that the state of soils causes the decrease of their functions in agroecosystems.

Characteristics of soil quality are based on both the characteristics of soil processes and points assessments, which measure both natural and acquired properties due to economic activity or anthropogenic changes. Thus, the "Regulation on the monitoring of soils on agricultural land" defines the soil processes as tasks [2, 3].

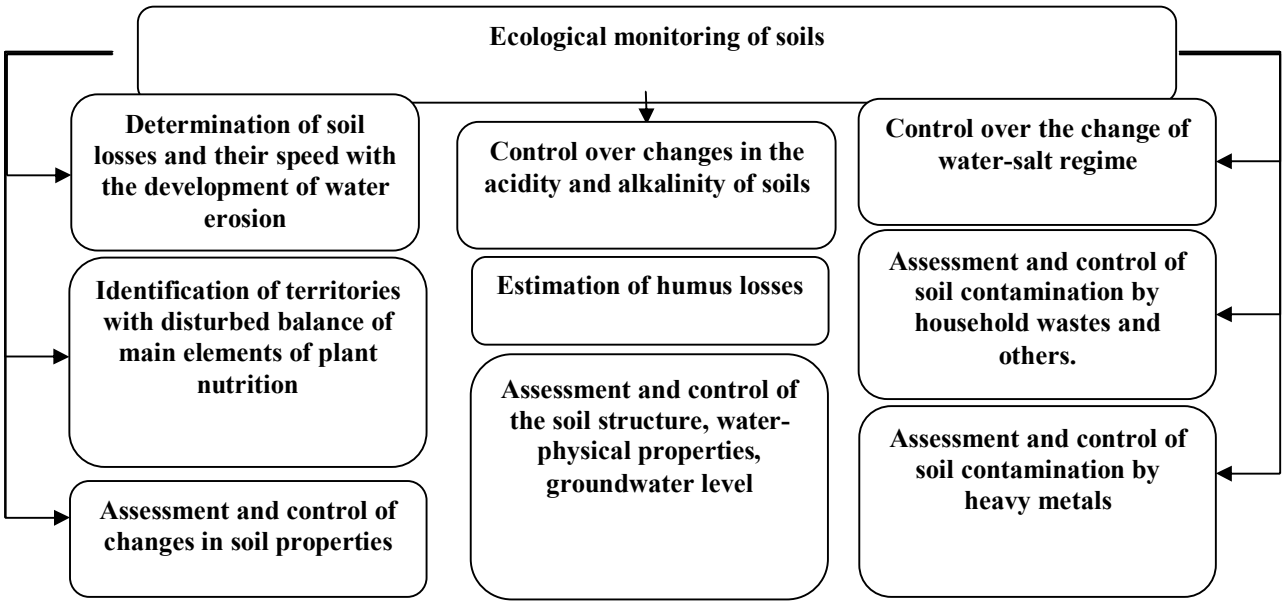


Fig. 1. The main components of the assessment of soil quality

Source: compiled based on [2, 3]

According to the existing foreign practice, differentiation can be carried out according to a ballistic evaluation system in which eight factors are taken into account: four "difficult variables" - the structure and granulometric composition of soils, their power, terrain, climatic conditions and four "easy variables" - the content of nutrients , moisture mode, acidity and rocky soils. In the end, these indicators can be considered as original quantitative and qualitative features of the ongoing processes of soil. The economic activity substantially affects the soil formation processes, and through them the properties and soil fertility, that is, its quality.

As experts believe, soils are largely a product of farming, and not just a subject of labor. Qualitative soil properties and fertility are inextricably linked. The processes of soil formation and soil fertility are determined by a number of natural factors and the nature of economic activity, which affects not only the arable layer but also deeper soil horizons, as well as groundwater and groundwater. The optimal parameters of fertility indices should be established for each type of soil, that is, they can vary according to the fertility patterns as a combination of soil properties and regimes that ensure land productivity, high quality and safety of the agricultural products derived from them.

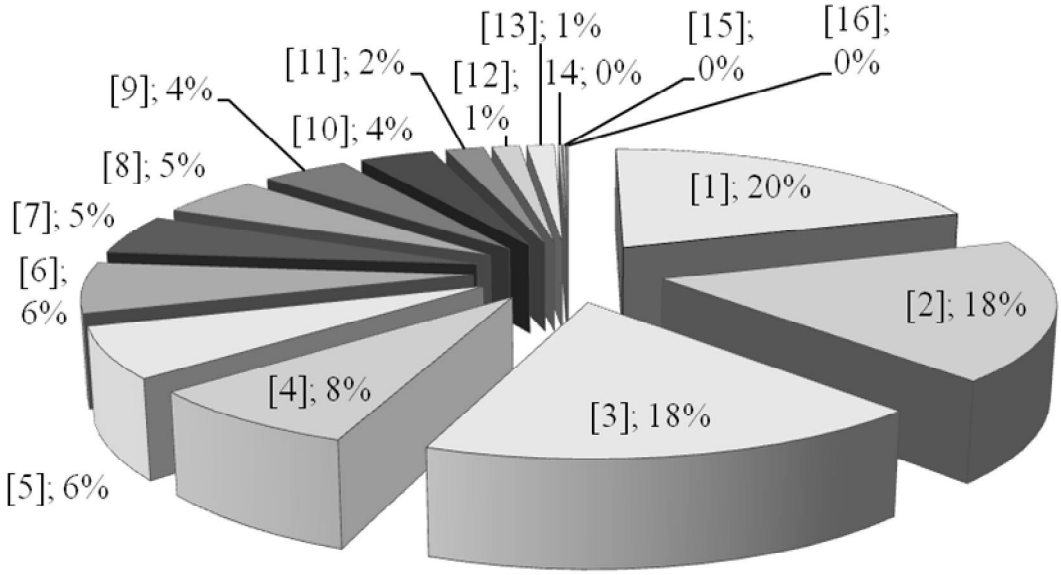
As you know, the current EU environmental policy envisages the implementation of consistent thematic strategies designed to introduce a new format of environmental policy in the identified areas over the long term. There are seven areas identified, including "Soil Protection". The EU Commission's Letter "Thematic Strategy for Soil Protection" identifies eight main threats to

soil degradation: erosion, quantitative and qualitative reduction of organic matter (humus), contamination, salinisation, compaction, landslides and floods, loss of biodiversity.

The draft Framework Directive for the European Parliament and the Council of Europe states that soil is, in fact, a non-renewable resource because the speed of their degradation can be significant and the processes of regeneration are extremely slow and costly [4]

According to official data, agricultural land in Ukraine occupies 42.7 million hectares, or 70.8% of the total land fund of the country. In their structure 68.8% of agricultural land. 53,9% of them are on arable land; 9.0% of the pastures; 4% - hayfields; 1.5% - long-term plantations; 0.4% - overflow. The highest proportion of arable land - in the steppe areas (70-80%) and forest-steppe zone. The peculiarity of the structure of agricultural lands in Ukraine is the general high proportion of cultivated land - 80% and even more in certain regions of the country, which far exceeds the ecologically sound limits.

The distribution of basic soil degradation processes in Ukraine according to the latest official data is provided on Fig. 2.



[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]
Loss of humus and nutrients	Overlapping	Infusion and cortex formation	Water erosion	Acidification	Waterlogging	Pollution by radionuclides	Wind erosion
[9]	**[10]**	**[11]**	**[12]**	**[13]**	**[14]**	**[15]**	**[16]**
Contamination with pesticides and other organic substances	Contamination with heavy metals	Salinity, salivation, salinization	Water erosion	Silting	Decrease the surface level	Deformation of the earth's surface by wind	Aridization of soils

Fig. 2. Distribution of the main soil degradation processes in Ukraine (% of total area)
Source: compiled according to the NSC "Institute of Soil Science and Agrochemistry" [5]

It is these processes that cause the greatest damage to the Ukrainian lands. Quantitative assessment of the consequences of these processes is presented in Table 1.

Table 1. List of measuring soil characteristics, properties and processes

Soil processes	*Quantitative-qualitative characteristic of soil condition*
Erosion	The average annual loss of soil from water and wind erosion is 15 t / ha. The soil cover of the country loses about 740 million tons of fertile soil each year, which contains about 24 million tons of humus, 0.7 million tons of mobile phosphates, 0.8 million tons of potassium, 0.5 million tons of nitrogen and large amounts micronutrients. On the territory of Ukraine there are 57.5% of the soils suffering from erosion. as a result of the area of eroded lands in Ukraine increases by 80-90 thousand hectares.
Quantitative and qualitative reduction of humus	The humus balance is severely deficient. Ukrainian soils lose 0.05% of humus on average every five years. This means that in the last 100 years the content of humus in black earth has decreased by almost half - from 4-6% to 3%, which leads to the loss of the most productive lands.
Pollution	About 20% of soils in Ukraine are polluted. Technogenically polluted lands are characteristic for industrial cities of Ukraine, as well as around objects of the oil and gas complex and off-road bands. There is an excess of MAC in feed and food products
Salinity	Approximately 2.8% of lands in Ukraine are salinized. The mineralization of groundwater in the zones of salinity fluctuated within the limits of 6300-8500 mg / dm^3, salinity depth to 28 m.
Consolidation	Soil redevelopment covers about 39%. According to various estimates, 18-40% of agricultural land
Landslides and floods	On the territory of Ukraine recorded almost 23 thousand landslides. The area of distribution of areas with the development of landslides within urban areas is more than 44.0 km^2. The threat of catastrophic flooding, flooding of coastal parts, especially in mountainous regions

Source: developed according to the data of the agrochemical certification of agricultural lands carried out by the State Technological Center for soil fertility conservation of the Ministry of Agrarian Policy of Ukraine "Center for Nutrition" and the regional centers of "Oblderzhrodyuchist".

According to the existing estimates, the territory of Ukraine can be characterized as strongly and very severely affected, and almost a fifth of it may become unsuitable for economic use. Meanwhile, innovative guidelines for the development of the Ukrainian economy provide for the production of ecologically pure products with a simultaneous reduction in the level of harmful effects on the environment. Getting such products is possible only on high quality land, that is, those where the ecological status of soils is controlled and their fertility is maintained.

The management of ecological agriculture will contribute to the creation of land uses with special characteristics, which are achieved through the implementation of the general laws of agriculture and a number of principles, among which the principles of environmental orientation combined with the principles that facilitate their implementation. So the first group consists of the principles:

- return to the natural conditions of phytocenosis formation, which manifests itself in accordance with the specialization of farms with the soil-climatic conditions of the territory;
- maintaining agroecosystem stability, which is achieved subject to crop rotation;
- application of natural plant protection products;
- neutralizing toxicants in fertile soils and preventing their use, and the second group - principles:
- rational land use, which involves scientifically grounded purposeful use of land plots, taking into account past experience, regional natural features and environmental safety of their use;
- economic regulation of land use that implements motivational, incentive and compensatory measures related to the return and maintenance of qualitative land properties (termination of erosion, deficit-free humus balance, pollution reduction, acidity and

salinity, optimization of fertilizer use, etc.) and biological productivity;

- innovative, aimed at applying in land tenure practice landowners and land users, regardless of ownership, modern science achievements in the field of ecologization of agrotechnologies;

- information provision, which consists in the formation of an updated database on the status of agricultural land;

- state control over land masses with special characteristics, aimed at improving and democratization of powers regarding land plots.

Differences in qualitative properties of land are objectively determined, but in due course anthropogenic load aggravates their primary characteristics. Returning to their original state is not always possible, but it is necessary. The application of certain approaches and technologies of updating the qualitative state of agricultural land causes the formation of conditionally clean land masses among those who potentially can become, after a certain time, suitable for obtaining safe production products. But, being in an intermediate state with respect to qualitative characteristics, such lands play a special role (Table 2).

Table 2. The role of land masses with special characteristics of quality in artificially created groups

Definition	*Features*	*Goal*	*Land massifs with special characteristics of quality*
Agrolandscape			
Set of ecosystems formed as a result of agricultural transformation of the landscape	Most of the natural vegetation is replaced by crops and plantings of field, garden and forest crops	Sustainable reproduction of resources and environment in the technological cycle to obtain the required quantity and quality of products, the formation of environmentally balanced high-yield agro-ecosystems	Reproduction of bioproductivity lands; humus formation; entomological self-regulation; formation of environmentally safe farming conditions; Improvement of the chemical state of soils
Agroareal			
Part of the agro-landscape, limited by the same geological and microclimatic conditions	For soils agroareal agrolandscape is characterized by the presence of an arable horizon	Agroecological group on the similarity of cultivation conditions of the main crops	Restoration and improvement of the natural state of certain parts of the agro-landscape, in order to synthesize the most ecologically clean land massifs
Agroecosystem			
Artificially created complex of biotic and abiotic natural components, which is in direct relation with the specimen. environment conditions	Unstable, incapable of prolonged existence without post, human maintenance	Rational use of biological resources in order to obtain high yields	Increase in yield; obtaining environmentally safe products; creation of ecological conditions of the existence of vegetation and animals
Agrobiocenosis			
Artificially created by a human group of plants, animals, mushrooms and microorganisms in the form of crops or plantings of cultivated plants	Insignificant species diversity, poorly branched supply chains, inability to self-regulate, the need for constant human intervention	Getting a high yield of one or more crops selected by man to grow	Improving the sustainability of crops to negative factors; formation of safe development

Source: compiled by authors on a base [6]

Ecologically clean land massifs, regardless of the degree of environmental readiness for economic use, are spatially limited, artificially created territories, the peculiar feature of which is the minimal cultivation of soil, the compliance with ampeloecological and agroecological requirements of cultivating those or other crops, the presence of indicator plants regulating contamination, the remoteness from pollutants, control of all agrotechnical measures, preservation and regulation of soil fertility. To achieve ecological purity is possible through a variety of activities.

Land massifs with special characteristics play an important role and have a close connection with modern agrotechnologies that differ from agrotechnical measures, with a more systematic and more closely related to the microperiods of agricultural crop development (Table 3).

Table 3. The role of ecologically clean land masses in alternative systems of farming

Agroareal	*Alternative agrotechnologies*	*The role of ecologically clean land masses*
Ecologically clean land massifs	Biodynamic	Preservation of ecologically safe state of components of biodynamic preparations (extracts from plants); support of a balance of nutrients in the soil; improvement of the quality and stability of crop rotation
	Organo-biological	Support for recirculation of nutrients; increase resistance to pests of local varieties and breeds
	Biological (organic)	Increase in humus soil balance
	Ecological	Improvement of the activity of microorganisms and ensuring their ecological safety
	Integrated systems	Diversification and ensuring the ecological status and sustainability of crop rotation

Source: compiled based on [7].

All listed agricultural systems are aimed at ecologization of agriculture, production using low cost technologies and innovative recommendations of agroecology, agrochemistry, breeding, etc. In other words, the primary nature of ecologically safe agriculture is not to "feed" the plants in order to obtain the expected yield, but to support the living matter of the soil.

Exploring the dynamics of the state of the land and the conduct of events, you can see a significant increase in areas of unproductive land, which adversely affects the transition to environmentally safe agriculture (Table 4). Rational ecologically safe land use requires the implementation of measures that will support the implementation of land management of rural areas, the formation of integrated land masses and ecologically clean land management and the reduction of processes that negatively affect the quality of land.

Table 4. The dynamics of the lands of Ukraine and the implementation of measures to improve it

State of land	*Area, thousand hectares*		*2014 to 2000*	
	2000	*2014*	*thnd*	*%*
Degraded	712,0	644,0	-68,0	-9,6
Low Productivity	26,0	435,4	+409,4	+1574,6
Technologically polluted land	120,7	11,9	-108,8	-90,1
Invalid land	161,7	144,5	-17,2	-10,6
In general	1020,4	1235,8	+215,4	21,1
Actions				
Conservation is carried out	2,4	2,5	+0,1	+4,2
In the stage of conservation	-	22,4	+22,4	+100
Reclamation was carried out	3,7	0,7	-3,0	-81,1
In the stage of recultivation	-	6,8	+6,8	+100
An improvement has been made	1,3	2,1	+0,8	+61,5
In the stage of improvement	-	3,2	+3,2	+100

Source: Developed by authors based on [5,8]

Formation of reproduction of bioproductivity of land, humus formation, entomological self-regulation, creation of conditions for ecologically safe agriculture, improvement of the chemical state of soils, etc. requires a series of measures to develop land management system and improve their qualitative components. Definition of land quality management as an object of research is shown on Figure 3.

<table>
<tr><td colspan="3">Land quality management is the process of studying and checking, controlling and supervising, directing and coordinating, as well as training personnel to ensure that the quality of the soil is matched to the established standards for food production.</td></tr>
<tr><td colspan="3">Functions:
– data collection, data entry, interpretation, correlation, data publishing and digital map development;
– coordination of the development of the ecological description of the territory;
– timely preparation of laboratory data, cartographic materials, etc.;
– ensuring registration of changes in the quality of land;
– forecasting and planning of land quality;
– assessment and analysis of land;
– quality control of land;
– lands for the promotion of land quality and responsibility for it.
– formation of initial decisions on land quality adjustment;
– soil quality control, to ensure compliance with food production standards</td></tr>
<tr><td colspan="3">The mechanism is a set of interrelated objects and subjects of management, used principles, methods and functions of management at different levels of quality management and consists in establishing a standard ampeloecological and agroecological quality of the land mass, the use of agrotechnologies for its achievement, constant comparison of the obtained quality with the standard, and with deviations - implementation of measures for their transformation.</td></tr>
<tr><td colspan="3">Objects are soil quality indicators, factors and conditions that determine their level, as well as processes of soil quality formation, in particular the state of ampeloecological and agroecological characteristics, properties and processes of land massifs affecting the functioning of the soil in the agro-landscape (natural landscape) and provide the vital functions of the plant, animal world and human beings.</td></tr>
<tr><td colspan="3">The subjects of quality management of land are the management bodies and individuals that implement management functions in accordance with established principles and methods.</td></tr>
<tr><td colspan="3">Methods:</td></tr>
<tr><td>Organizational (administrative):
– orders (directives, orders, etc.);
– regulatory (norms, norms, regulations),</td><td>Disciplinary (responsibility and encouragement);
– socio-psychological:
– motivational;</td><td>Technological and technological:
– methods of technological regulation of quality and processes;
– economic: pricing taking into account the quality of land</td></tr>
</table>

Fig. 3. Land quality management as an object of research

Source: compiled based on [7]

Under management is understood the process of influencing the object of management to bring it to a new state or maintain it in the established regime in order to ensure a given level of quality agricultural land and obtained from its economic use of products. In a generalized way, the content signs of the land quality management process determine the essence, objectives, functions and management methods.

The organizational component of the management process is focused on planning the choice of a solution to the problem (preparing an alternative choice). In the foreseeable future, certain activities are defined, and within the limits of the current planning, organization, motivation, coordination, regulation, changes of plans, an understanding of the way of realization of the indicated measures and their information provision is formed.

The management process for the intended purposes is realized by means of appropriately selected methods and levels - state, regional, sectoral, local (internal). Implementation of measures within the hierarchy of management allows addressing the appropriate level of planned measures to improve the state of land, ensure the continuity and efficiency of management, gradually improve the quality of land, choose the most efficient tools, rationally employ the personnel resources, and ensure the interaction of management subsystems.

Conclusions and further research. The problem of allocating territories with special ecologically safe characteristics remains essential. Reducing the negative impact of agricultural production on the natural environment requires the improvement of land use. An updated concept of soil protection from degradation, which involves the introduction of innovative agrotechnical measures and ecologically balanced technologies, will be needed. The implementation of these measures involves the introduction of systematic soil quality management. Management defines the essence, goals, functions, methods of management, choice of the option in accordance with the levels of problem solving.

REFERENCES

1. Hadzalo, Ya.M., Lupenko, Yu.O., & Puhachov, M.I. (2016). Development of the economy of Ukraine's agriculture in 2011-2015. Yu.O. Lupenko (Ed.). KYIV: NNC «IAE» [in Ukrainian].

2. Patyka, V.P., Solomakha, V.A., Burda, R.I., Boiko, A.L., Hlazko, V.I., & Hlazko, T.T., et al. (2003). Prospects for the use, conservation and reproduction of agrobiodiversity in Ukraine. KYIV [in Ukrainian].

3. On approval of the Regulation on the monitoring of soils on agricultural lands: Provision of 26.02.2004 № 51. (2004). Ofitsiinyi visnyk Ukrainy, 13, 922. [in Ukrainian].

4. Yatsuk, I. (2013). Soils need protection. Retrieved from http://www.iogu.gov.ua/publikaciji/statti /grunty-potrebuyut-zahystu [in Ukrainian].

5. National report on the state of the environment in Ukraine in 2000. (2001). Kyiv: Ministerstvo ekolohii ta pryrodnykh resursiv Ukrainy [in Ukrainian].

6. Musiienko, M.M., Serebriakov, V.V., & Braion, O.V. (2004) Ecology: Explanatory Dictionary. Kyiv: Lybid [in Ukrainian].

7. Kupynets, L.E. (2010) Ecologization of the food complex: theory, methodology, mechanisms. Odessa: IPRJeJeI NAN Ukrainy: [in Russian].

8. Natsionalna dopovid pro stan navkolyshnoho pryrodnoho seredovyshcha v Ukraini u 2014. (2016). Kyiv: Ministerstvo ekolohii ta pryrodnykh resursiv Ukrainy [in Ukrainian].

9. Barvinskyi, A.V., & Tykhenko, R.V. (2015) Estimation and forecast of land quality. Kyiv: Medinform [in Ukrainian].

10. Tykhonov, A.H., Hrebeniuk, N.V., Tykhonenko, O.V., & Fedorenko, V.P. (2002) Scientific principles of sustainable development of land use: principles, indicators, indicators. Zemlevporiadkuvannia, (2), 13-21 [in Ukrainian].

11. Helaina, Black, Patricia, Bruneau, & Karen, Dobbie. (2012). Soil Monitoring Action Plan: report. Scotland: Soil Focus Group monitoring sub-group.

ЛІТЕРАТУРА

1. Розвиток економіки сільського господарства України в 2011-2015 р.р.: наукова доповідь / [Гадзало Я.М., Лупенко Ю.О., Пугачов М.І. та ін.]: за ред. Ю.О. Лупенка. – К.: ННЦ «ІАЕ», 2016. – 546 с.

2. Перспективи використання, збереження та відтворення агробіорізноманіття в Україні: монографія / [В.П. Патика, В.А. Соломаха, Р.І. Бурда, А.Л. Бойко, В.І. Глазко, Т.Т. Глазко, М.В. Калінчик, М.О. Петровський, С.І. Губар, Ю.М. Скупятін, А.М. Малієнко, В.П. Поліщук, Я.І. Мовчан, Т.Д. Соломаха, Є.О. Воробйов]. – К.: Хімджест, 2003. – С. 60-61.

3. Про затвердження Положення про моніторинг ґрунтів на землях сільськогосподарського призначення: Положення від 26.02.2004 № 51 / Офіційний вісник України. – 2004 р. – № 13. – ст. 922. –317 с.

4. Яцук І. Ґрунти потребують захисту [Електронний ресурс] / І. Яцук // Журнал Верховної ради України «Віче». – 2013. – №15. – Режим доступу: http://www.iogu.gov.ua/publikaciji/statti/grunty-potrebuyut-zahystu/

5. Національна доповідь про стан навколишнього природного середовища в Україні у 2000 році: проект / К.: Міністерство екології та природних ресурсів України, 2001. – 184 с.

6. Мусієнко М. М. Екологія: тлумачний словник / М.М. Мусієнко, В.В. Серебряков, О. В. Брайон. – К.: Либідь, 2004. – 376 с.

7. Купинец Л.Е. Экологизация продовольственного комплекса: теория, методология, механизмы / Л.Е. Купинец; ИПРЭЭИ НАН Украины. – Одесса: 2010. – 720с.

8. Національна доповідь про стан навколишнього природного середовища в Україні у 2014 році. – К.: Міністерство екології та природних ресурсів України, 2016. – 350 с.

9. Барвінський А.В. Оцінка і прогноз якості земель: підручник / А.В. Барвінський, Р.В. Тихенко. – К.: Медінформ, 2015. – 642 с.

10. Тихонов А.Г. Наукові засади сталого розвитку землекористування: принципи, індикатори, показники / А.Г. Тихонов, Н.В. Гребенюк, О.В. Тихоненко, В.П. Федоренко // Землевпорядкування. – 2002. – №2. – С. 13-21.

11. Helaina Black, Patricia Bruneau, Karen Dobbie. Soil Monitoring Action Plan: report / Soil Focus Group monitoring sub-group. – Scotland, 2012. – P.4 – 30 p.