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THE IMPORTANCE OF AGROECOLOGY IN THE PROCESS OF WELL-BALANCED AGROSPHERE FORMATION

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Contemporary realities demonstrate actual features of the environmental crisis in agrosphere which is considered to be both the result of technological impact on its components, and also sharp decline of public morals and the lack of foresight regarding further consequences of the collision of the long-established lifestyle. In this respect the foreground of overcoming environmental problems in the agrarian sphere is taken by the main trends in agroecology. The article discloses the significance of agroecology as a fundamental of well-balanced agrosphere formation, environmental protection, rational use and renewal of natural resources and ensuring ecological safety. It is substantiated that in current complicated environmental and economic conditions agroecology should define the development strategy of agricultural production with the obligatory account of environmental, social and economic factors. The place of agroecology in the system of agrarian sciences and a number of priority tasks of agroecology at the current stage of agricultural science development and production in Ukraine are defined. The main aim of agroecology is to ensure sustainable production of quality and safe products, storage and renewal of natural resource potential of the agricultural sector, which means ecological safety of all branches of agricultural production with their economic feasibility. Agrosphere management calls for urgent development of new scientifically grounded approaches, based on the main principles of the Sustainable Development Concept. Thoughtful management of environmental processes in agrosphere, balanced needs of economic development and opportunities for the renewal of natural resources, comprehensive realization of environmental measures and technologies in AIC are the basis of the sustainable development of the country, life duration, strong health and well-being of present and future generations.

Key words: agroecology science, agrosphere, sustainable development, environment, natural resources.

Considering the implementation of the provisions of the Sustainable Development Concept and the transformation processes in the human perception about the re-estimation of the relevance of environmental quality and safety, as well as the use of natural resources, it is impossible not to recognize the priority significance of agroecology at the current stage of the agriculture development.

The benchmarks, primarily targeted at economic results and the implementation of scientific achievements and novel technologies without any consideration for the priority of the development of ecological and social factors, gradually pass into history.

Many scientists believe that Ukraine has got all the features of the ecological crisis, which is now viewed as the crisis of existence philosophy, the crisis of spirituality.

The degradation of environment results both from the technological impact and sharp decline of public morals, lack of foresight regarding further consequences of the collision of the long-established lifestyle.

Taking the abovementioned into account, the foreground of overcoming the ecological problems in the agriculture is gradually taken by the main trends of agroecology.

In current complicated ecological and economic conditions agroecology determines the strategy of developing the agricultural production, which should be aimed at the maintenance and renewal of soil, water

and biological resources first and foremost, the environment protection and the provision of high-quality food products in sufficient amounts for people.

Agroecology is formed as an independent branch of science at the interface of many disciplines. On the one hand, it is based on the set of natural sciences, including general ecology, physiology, chemistry, morphology, physics, meteorology, hydrology, biochemistry, mathematics, etc., and on the other hand it is grounded on the industrial sciences on crop cultivation and livestock production, including agriculture, plant cultivation, agrochemistry, soil science, agroforestry, forestry, melioration, animal husbandry, animal science, biotechnologies, biosafety, environmental management, etc. (Figure).

In addition, agroecology is closely related to environment safety and social ecology. Agroecology is the science, which focuses on the study of agrosphere in general, investigates the foundations of the sustainable use of agricultural land for obtaining crop and livestock products and their processing with simultaneous preservation of natural resources (biota, soil, water, atmospheric air, etc.), biotic diversity and the protection of human environment and manufactured goods from contamination [2].

Although agroecology is the interdisciplinary science, yet it belongs to agricultural sciences with the dominating emphasis on the elaboration and scientific substantiation of the measures, required for obtaining high-quality and safe agricultural products, preventive estimation of undesired consequences of the negative impact of human activity on agroecosystems, biogeocenoses and landscapes in general, and the elimination of the mentioned consequences.

The founder of the domestic agroecological science, full-member of NAS of Ukraine, NAAS and RAAS, Sozinov O. O. emphasized that modern agroecology is complex science, based on the synthesis of many sciences and grounded on the systemic approach, presupposing the use of political, economic and other factors.

The implementation of agroecology achievements in the Ukrainian context does not require immense additional expenses; on the contrary, it would ensure more efficient utilization of our natural potential. The only requirement is the political will of state authorities to implement the principles of agriculture biologization and the formation of stable agricultural landscapes and agroecosystems [3].

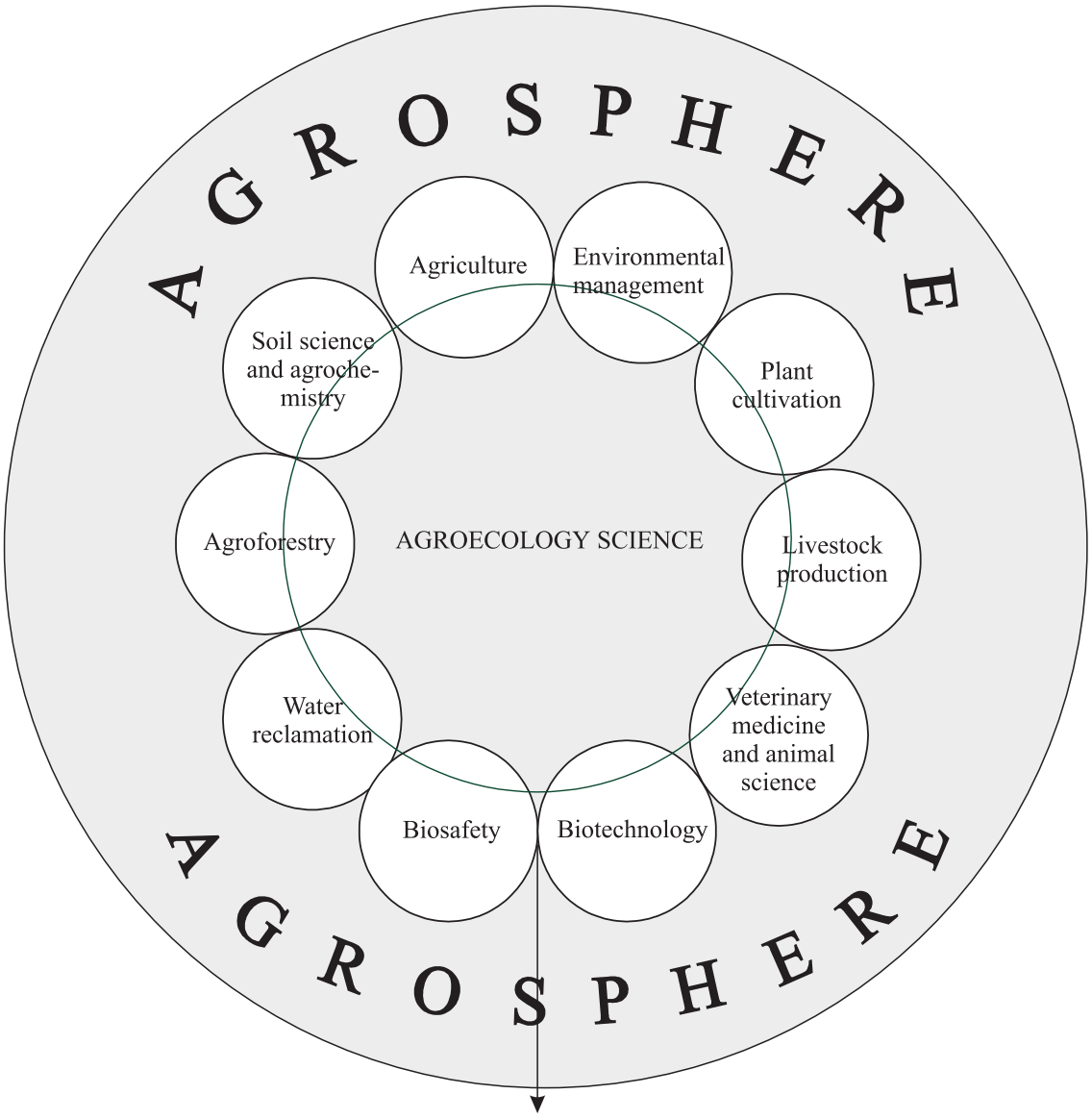
Agroecological investigations are a specific synthesis of environmentology (environmental science) and ecosozology (science of natural environment protection).

Agroecology acts both as a sectoral agricultural science that studies the agrosphere to meet the needs of humanity and also explores general agroecological problems related to nature preservation, which is an important component of sustainable environment development.

The main aim of agroecology is to ensure sustainable production of quality and safe products, storage and renewal of natural resource potential of the agrarian sector, i.e. the ecological safety of all the branches of agriculture along with their economic feasibility. It studies human interaction with the environment in the process of agricultural production, namely, the impact of agriculture on natural systems, the interaction between the components of agroecosystems, energy transfer, and the specificities of functioning of agroecosystems in conditions of technological impact [4].

Agroecology and environmental management are two related and interconnected sciences, designed to create the new philosophy of agrosphere knowledge and resource management of animate and inanimate nature, primarily renewable man-made resources, created in the process of proper production, with the purpose of preserving a dynamically sustainable state of environment as well as ensuring better life for current and future generations, and providing for social adaptation of society to regular changes in the environment. It means that agroecology is the scientific study of agrosphere state and dynamics, while environment management presupposes practical measures for the use of natural objects and recommendations regarding the technologies of using natural resources, monitoring of their condition and searching for the ways of optimizing the ecological and economic indicators of activities of the acting agents. Therefore, agroecology should become a leading force in solving the problems of sustainable nature management and ensure obtaining high quality and environmentally safe agricultural products [1].

The object of agroecology research is agrosphere, and its subject is human relations with the environment in the process of agricultural production, the impact of agriculture on natural systems, the relations between the components of agroecosystems and the specificities of circulation of substances, energy and information therein under the anthropogenic impact. Agroecology as a science considers agricultural systems and technologies of crop cultivation and livestock production



RESULTS

SCIENTIFIC:
– new knowledge about agroecology and other related natural sciences;
– new knowledge about agrosphere and its constituents;
– new knowledge about functional relations in agroecosystems;
– methodology (systems of notions, methods and technologies) of scientific research in agroecosystems

APPLIED SCIENTIFIC:
– methodological and scientific practical recommendations for production;
– agroecological requirements for anthropogenic factors (*chemicals, mechanical, equipment, technological practices and activities,technologies etc.*);
– agroecological requirements to the state of natural resources according to their target purpose (*organic production, production of raw materials for dietary and baby food, recreation, woodland conservation of agricultural lands, structure of agricultural land etc.*);
– technological requirements to waste disposal in agriculture, handling of highly toxic pollutants and radioactively contaminated territories

Agroecology in the system of agrarian sciences [1]

in the terms of the utilization and renewal of natural resources; it also assesses the validity of ecological solutions. It should develop theoretical foundations for ecologically disposable and harmless crop cultivation and livestock production, and design the formation of agricultural landscapes, ensuring harmonious balance (homeostasis) with biosphere.

Agrosphere is both the main source of providing the human population with food and raw materials for food and light industry (mostly due to solar energy and other natural resources – soil, water, climatic factors, etc.), and also the habitat of the majority of the population. It is remarkable for specific fundamental regularities of internal development, which result from the interaction of various natural and socio-economic factors [5]. So agroecology, the main purpose of which is the harmonization of relations of agrosphere and natural environment, is the one to determine the ways of sustainable development of the agrarian sector [6].

Therefore, agroecology should be understood as a comprehensive agricultural science that studies all contemporary environmental issues related to the agro-industrial production and the ways of applying the environmental protection principles in all the branches of AIC. Methodologically, it is important to ensure the ecological direction in the agricultural technologies taking into account the trends of scientific and technological progress, specialization characteristics and concentrations according to natural and commercial zones. Nature-viability concept should be built into the industrial system, and in order to evaluate productivity it should be considered as the ratio of manufactured products and quantities of used resources and received waste. The requirements of rational nature management should be considered in all the subsystems of modern agriculture (sphere of manufacturing the farm production supplies, sphere of material and technical supplies service for agriculture, agricultural industry, harvesting, storage, primary processing and marketing of agricultural products).

The main and perhaps ultimate aim of agroecology is to find the formula of optimal ratio, i.e. the balance in cultivating plants and producing livestock under certain environmental conditions. The measure of this ratio is the productivity of agricultural plants and animals, which, in addition to quantitative indicators, should be characterized by high quality products and safety for environment; and this is largely determined by the characteristics of ecological processes in agrosphere.

The evolution of agroecology depends on the development of natural processes in biosphere, human relations with the environment, as well as political and economic processes in the society. The retrospective studies suggest that thousands of years ago spontaneous human activities led to significant environmental changes, which sometimes compromised the existence of mankind [7]. During the long history of humanity their relations with environment were unequal and constantly changing.

Agriculture has got the longest standing and remains the most powerful factor of terrestrial ecosystems and biosphere transformation in general. The development of settled agriculture caused the first serious anthropogenic biosphere shock. Crises, cataclysms and other disorders of environmental conditions within civilization were not uncommon. In the past centuries, the resolution of such crises was quite simple: the center of economic development shifted to another area or a person changed the way of management. At the end of the XX century humanity felt the beginning of one more environmental crisis, which had qualitatively different origin compared to all previous ones. This crisis was caused by technological and production factors, including agricultural production. General degradation of global environment was started. The elements of civilization pressure on environment were the technologies with significant financial expenses and large hazardous wastes, used in industry and agriculture.

Agrosphere in Ukraine covers more than 70% of the total area. Its first “islands” arose as a result of the Neolithic revolution about 8−10 thousand years B.C. (Trypil culture). Its significant development occurred in the XIX century. The main contradictions between agrosphere and environment in those days was the expansion of the former due to forests destruction as well as steppe ecosystem damages because of substantial increase in the number of sheep in these areas. However, in general the effect of anthropogenic factors in those times did not lead to homeostasis disorders in global environment. Nevertheless, even on the verge of the last century such outstanding scientists as Vernadskyi V., Dokuchaev V., Kostychev P., Vysotskyi G., and Izmailskyi O. warned about possible environmental crisis due to the growing anthropogenic pressure on agrosphere. They substantiated the need for purposeful actions for conservation and restoration of natural resources, including agricultural and forest lands, water and forest ecosystems etc.

In the second half of the XX century, the situation began to change rapidly as a result of active industrialization of agriculture and the increase in the negative influence of industry and urbanized areas on agrosphere. The area of arable lands increased dramatically, the intensity of their cultivation enhanced, the processes of soil erosion accelerated, and soil degradation and contamination by xenobiotics deepened. Small rivers gradually disappeared, in many areas the hydrological regime was broken, which was partially caused by gross mistakes in water melioration.

However, in this period there was also considerable work, carried out on land management, forest melioration, and introduction of crop rotation, the application of mineral and organic fertilizers was increased, resulting in greatly improved crop productivity, and the increase in the number of animals. The 80s witnessed the beginning of the implementation of the soil-protecting and profile melioration system, developed by domestic scientists. Nevertheless, the ecological crisis in the agrosphere of Ukraine deepened, which was particularly acute after the Chernobyl nuclear disaster.

The reasons of current complicated environmental situation in the agrosphere include the following factors: the inefficiency of public administration, unsatisfactory use of economic instruments for the implementation of environmentally-friendly technologies, low level of ecological culture of both manufacturers and population, low activity and efficiency of environmental organizations and social movements.

Special attention should be paid to the issue of implementing and setting up the system of national agroecological monitoring, using modern information and space technologies, assessing the degree of contamination of all components of agricultural landscapes by pathogenic organisms (viruses, bacteria, micromyceta), organic xenobiotics and heavy metals, the study of migration and transformation of toxicants in the soil and in the soil – plant – animal – human system etc. Another relevant trend is also the development of the methods and techniques of contaminated soil remediation and their return into the agricultural production.

In most countries the peculiarities of agricultural production are determined by the priority of the consumer-related function. Providing people with food and raw materials requires intensification of all the agricultural sectors, which has caused degradation processes in agrosphere. While in the beginning of the XX century they were local, now they have become wide-spread and global, and require fast optimization of agricultural production.

Modern agroecology, based on the integrated and systematic approach, determines the ways of agroecosystem transition to the foundations of sustainable development. This means that permanent obtaining of the required amount of high quality and competitive products should be carried out with limiting the anthropogenic energy, the restoration of natural resources, the formation of well-balanced agroecosystems and minimum environmental contamination, based on the criteria of rational use of natural resources and bioethics principles.

Agrosphere is man-made and continuously man-maintained; it is inertial in its essence. Its management requires systematic approach and scientifically substantiated strategy. Regardless of the fact that agrosphere is mostly an anthropogenic system, according to its fundamental essence it is a part of biosphere, and the basic mechanisms, remarkable for the latter, operate therein. This means the presence of photoautotrophs and hemoheterotrophs (including humans); this involves the circulation of biogenic elements and energy, and the balance of pathogenic factors interaction (viruses, microorganisms, insects) with plants and animals. The violation of this balance may have catastrophic consequences [8].

It is well known that the foundation and basis of existence and balanced state of the biosphere is biodiversity. With its deterioration the whole system becomes unstable, which can lead to its complete collapse. This is especially true for agroecosystems. Unfortunately, the problems of biodiversity preservation in the agrosphere have not been considered properly. Due to agricultural production intensification, humans have mistakenly thought about the dominance of anthropogenically-controlled factors in solving all the problems in agrosphere, especially related to equipment, fertilizers, crop protection chemicals and animals. However, humans almost forgot about the fundamentals of biological system functioning, about the mandatory existence of the corresponding biodiversity in agroecosystems. The underestimation of this factor, the lack of studies to identify the ways of biodiversity preservation endangers the possibility to achieve sustainable development of agroecosystems and consequently the well-being of the population [9].

Undoubtedly, the function of the main man's breadwinner will always be performed by agrosphere. However, this goal must be achieved on the basis of the prior-

ity of natural resources preservation, the improvement of production quality, a significant increase of efficiency of solar energy using, especially by green plants, the intensification of microbiological processes in soil as an important link of substances circulation in agroecosystems, in particular biological nitrogen fixation and phosphorus mobilization. This requires not only new ways of solving problems in social and economic relations in the sphere of agricultural production, but also new relations between agrosphere, technosphere and urbosphere, the application of high energy saving and environmental protection technologies.

The problem of forming a new sustainable agrosphere is of special importance for Ukraine. There is an urgent need to define a new development strategy for both agricultural production and agrosphere in general. We need decisive action and support at the state level for the implementation of the main provisions of the Sustainable Development Concept, the agrosphere formation based on its principles, and the biospheric-noospheric approach, founded on the ideas of Vernadskyi V. First of all, it requires the development of the Agrosphere Model of Ukraine for the XXI century that would be based on the well-established principles of agroecology and economic science, taking into account the mechanisms, active in the agrosphere as a part of the biosphere. It is necessary to take into account the qualitative changes in environment, which resulted from significant increase in the anthropogenic impact on environment in the XX century and modern tendencies of global climate change etc.

There is still no economic incentive of environmentally friendly technologies introduction in Ukraine. The application of innovative, resource-saving and environmental protection technologies, including the technologies of agricultural waste disposal and utilization, is on the low level.

Negative processes occur especially rapidly in the recent decades, when there are all the features of global climate changes, the number of technological disasters increases, and industrial technologies usually do not meet current requirements of environmental safety. Therefore, the issue of creating sustainable agricultural landscapes, increasing the area of environmentally stabilizing lands and optimizing the area of forest plantations in the structure of agricultural landscapes, the preservation and restoration of natural resources in general, is still urgent. As for the field of crop cultivation and livestock production, it is necessary to focus on the elaboration of environmentally safe technologies, suitable for obtaining of high quality agricultural production with sustainability of natural resources (land, water, biological resources) with the minimum environmental impact.

Finally, it should be mentioned that only the awareness of the importance of agroecology in modern agricultural production, the thoughtful management of environmental processes in agrosphere, balanced needs of economic development and opportunities for reproduction of natural resources, comprehensive realization of agri-environmental measures and technologies in AIC are the basis of the sustainable development of the country, life duration, strong health and well-being of present and future generations [1].

Значення науки агроекології у формуванні збалансованої агросфери

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Реалії сьогодення свідчать про наявні ознаки екологічної кризи в агросфері, що розглядається не лише як наслідок техногенного тиску на її складові, а й зубожіння моральності суспільства, недалекоглядності щодо майбутніх наслідків колізій усталеного рівня життя. З огляду на це на передній план подолання екологічних проблем в аграрній сфері виходять основні напрями науки агроекології. В огляді розкрито значення науки агроекології як фундаментальної основи формування збалансованої агросфери, охорони довкілля, раціонального використання та відтворення природних ресурсів, а також гарантії екологічної безпеки. Обґрунтовано, що наука агроекологія за сучасних складних екологічних та економічних умов повинна визначати стратегію розвитку аграрного виробництва з обов'язковим урахуванням екологічних, соціальних і економічних чинників. Визначено місце науки агроекології у системі аграрних наук та низку пріоритетних завдань на сучасному етапі розвитку аграрної науки і виробництва України. Головною метою агроекології є наукове забезпечення збалансованого виробництва якісної і безпечної продукції, збереження і відтворення природно-ресурсного потенціалу аграрного сектора, тобто екологічна безпека всіх галузей сільського виробництва за економічної доцільності. Зазначено, що управління агросферою потребує розроблення нових науково обґрунтованих підходів, які базуються на основних принципах Концепції сталого розвитку. Продумане управління екологічними процесами в агросфері, збалансованість потреб економічного розвитку і можливостей відтворення природних ресурсів, комплексна реалізація екологічних заходів і технологій

в АПК – це основа стабільного розвитку держави, тривалості життя і міцного здоров'я та благополуччя нинішніх і прийдешніх поколінь.

Ключові слова: наука агроекологія, агросфера, збалансований розвиток, навколишнє природне середовище, природні ресурси.

Значение науки агроэкологии в формировании устойчивой агросферы

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Реалии сегодняшнего дня свидетельствуют о наличии признаков экологического кризиса в агросфере, что рассматривается не только как следствие техногенного прессинга на ее составляющие, но и обнищания нравственности общества, недальновидности относительно будущих коллизий в устоявшемся уровне жизни. В этой связи на первый план при преодолении экологических проблем выходят именно основные направления науки агроэкологии. В обзоре раскрыто значение науки агроэкологии как фундаментальной основы формирования сбалансированной агросферы, охраны окружающей природной среды, рационального использования и воспроизводства природных ресурсов, а также гарантии экологической безопасности. Обосновано, что наука агроэкология в современных сложных экологических и экономических условиях должна определять стратегию развития аграрного производства с обязательным учетом экологических, социальных и экономических факторов. Определено место науки агроэкологии в системе аграрных наук, а также приоритетные задачи на современном этапе развития аграрной науки и производства Украины. Главной целью агроэкологии является научное обеспечение сбалансированного производства качественной и безопасной продукции, сохранения и воспроизводства природно-ресурсного потенциала аграрного сектора, то есть экологическая безопасность всех отраслей сельского производства при экономической целесообразности. Определено также, что управление агросферой требует разработки новых научно обоснованных подходов, базирующихся на основных принципах Концепции устойчивого развития. Продуманное управление экологическими процессами в агросфере, сбалансированность потребностей экономического развития и возможностей воспроизводства природных ресурсов, комплексная реализация экологических мероприятий и технологий в АПК – это основа стабильного развития государства, продолжительности жизни и крепкого здоровья и благополучия нынешних и грядущих поколений.

Ключевые слова: наука агроэкология, агросфера, сбалансированное развитие, окружающая среда, природные ресурсы.

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