

# Green agro-production as a factor of competitiveness, sustainability, efficient and ecologically safe agriculture

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**Abstract.** The purpose of the study is to identify the status of the development of green agro-production as a factor of competitiveness, sustainability, efficient and ecologically safe agriculture. The results of the study made it possible to analyze the problems of agricultural production and show that green agro-production is an approach to agricultural production that seeks to ensure the production of products with minimal negative impact on the environment and natural resources. In this study, the authors use the method of systemic analysis and synthesis, cross-cultural approach, and general philosophical methods that allowed to show the development of green agro-production aimed at efficient and ecologically safe agriculture. It is concluded that forming the green transformation of agro-production was carried out as a necessity to stabilize the basic situation in agriculture; the concept of green agro-production was formed as a condition for a sustainable, ecologically safe, and fair system of agricultural products, promoting people's health and preserving nature; components of green agro-production concepts aimed at effective and ecologically safe agriculture are defined; the concept of green agriculture was formed as the basis of efficient and ecologically safe agro-production.

## 1 Introduction

Today, with the emergence of various food problems, agro-production as a branch in the development of agricultural products is an extremely relevant topic. Agro-production is a sector that uses the natural environment of the earth to produce agricultural products and sell them for profit. It is an important industry that supplies the food needed for our daily lives and also plays an important role in preserving the environment and revival of regions. Looking at the 21st century from a global perspective, conditions are predicted that the world's population is growing rapidly, and human activities are leading to food shortages and global environmental pollution, which will become even more serious. On the basis of these forecasts, it is necessary to highly develop and use the multifaceted functions of crop

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production and animal husbandry, while paying attention to environmental preservation, as well as to build highly productive and sustainable agriculture. For this, not only traditional biology is used, but also molecular biological methods aimed at creating new technologies of agro-production and their systematization. Therefore, it is important to identify the significance, prospects, and ways in the development of agro-production and analyze its attributes. The man should play an active leading role in the process of "green" transformation of agro-production so that everyone can enjoy healthy and safe meals, foodstuffs, and environmentally friendly production. Various food safety issues have arisen in recent years, leading to calls for a "green turn" in agro-production. At the same time, the state should play an active leading role in this process so that all people can enjoy the healthy and safe food that will come as a result of the green transformation. In recent years, various problems of environmental pollution in agriculture and food safety have sharply increased, which have seriously affected the development of agro-production. Accordingly, voices in favor of agricultural safety are becoming louder, and the development of green agro-production is becoming an urgent task. Green agro-production means "the full use of advanced science and technology, advanced industrial equipment, and advanced management concepts to promote the coordination and unification of agricultural product safety, environmental safety, resource safety, and the improvement of comprehensive economic benefits for agriculture" and promotion of agricultural standardization as a means. The formation of green agro-production as a factor of competitiveness and sustainability contributes to the comprehensive, coordinated, and sustainable development of human society and economy, including not only organic foodstuffs, green foodstuffs but also ecologically clean agricultural products. Therefore, **the relevance** of the study lies in the need to develop the concept of green agro-production as a factor of competitiveness, sustainability, efficient and ecologically safe agriculture. The purpose of the study is to develop a model of green agro-production as a factor of competitiveness and sustainability. [1]

## 2 Literature review

Green agro-production is an approach to agricultural production that seeks to ensure the production of products with minimal negative impact on the environment and natural resources. This approach involves the use of environmentally friendly methods and technologies and also contributes to the preservation of biodiversity and the support of ecosystems. The concept of environmentally safe production (ESP) has its roots in the works of various authors and organizations that contributed to the development of the concept of environmentally safe production. One can name Rachel Carson, the author of the book "Silent Spring", where the first criticism of chemical pesticides and their effects on the environment and human health was given. The work had a significant impact on the global movement for environmental safety and production. A significant role was played by the work of E. F. Schumacher, the author of the book "Small Is Beautiful", in which he expressed ideas about the importance of small-scale, decentralized and ecologically oriented farms. For our study, Donella Meadows, Dennis Meadows, and George Forrester's: "The Limits to Growth", published in 1972, is of great importance, in which they expressed concern about the limited resources of the planet and the need for sustainable development. One should mention Gunnar Myrdal and Barbara Ward, the economists who actively worked on the ideas of sustainable development and environmental security on a global scale. World Commission on Environment, known as the Brundtland Commission, was created by the UN in 1983 under the chairmanship of Gro Harlem Brundtland and published the report "Our Common Future", in which it first defined the concept of sustainable development and the importance of combining social, economic and ecological aspects of development. These authors and organizations made a significant contribution to the understanding and popularization of the

concept of environmentally safe production and sustainable development. A major role was played by the works of Voronkova Valentyna H., Nikitenko Vitalina A., Teslenko Tatyana V., Bilohur Vlada E. *Impact of the worldwide trends on the development of the digital economy* (2020); Voronkova, V., Nikitenko, V., Oleksenko, R., Andriukaitiene, R., & Polysaiev, O. *Environmental crisis overcoming as a factor for achieving economic sustainability in the context of the European green course* (2023). The Declaration on Environment and Development, also known as the Rio Declaration, was adopted in Rio de Janeiro in 1992. The United Nations and its World Commission on Sustainable Development: The United Nations plays an important role in promoting sustainable development and the development of environmentally safe production concepts. The World Commission on Sustainable Development was founded to provide recommendations in the field of environmental security and sustainable development. A number of non-profit organizations and activists around the world, such as Greenpeace, Friends of the Earth, WWF, and many others, are actively working to popularize the concepts of environmentally safe production and sustainable development through campaigns, education, and lobbying. [2] Together with the above-mentioned individuals and organizations, they continue to work towards choosing sustainable production and promoting nature conservation, reducing the negative impact on the environment and ensuring environmental security for modern society and future generations.

### **3 Research methods**

To achieve the purpose, the authors used interpretative and analytical methods during the research, with the help of which analyzed the implementation of the green transformation of agro-production as the need to stabilize the basic position of agriculture, directions of its development through analysis, synthesis, generalization, and systematization. Considering the importance of the philosophical component in identifying the advantages and disadvantages of green agro-production, the leading place among general scientific methods is held by general philosophical methods – comparison, analysis, synthesis, deduction, and induction. First of all, we are talking about the use of analysis and synthesis, which made it possible to initially divide the main subject of the study into several smaller parts (problems) in order to analyze the concept of green agro-production as a condition for a sustainable, ecologically safe and fair system in the production of agricultural products, promoting health people and nature conservation. Then, based on the above-mentioned methods, these separate parts were combined. It allowed us to determine both the features in the development of the components for the concept of green agro-production, aimed at efficient and ecologically safe agriculture, and to analyze the trends of its further development. The features of the concept of green agriculture as the basis of effective and environmentally safe agro-production allowed us to analyze the methods of a comprehensive approach, as well as a number of general scientific theoretical methods, such as the method of system analysis and synthesis, content analysis, system-axiological, prognostic and comparative methods in researching the concepts of environmentally safe production and sustainable development. Taking into account humanistic, all-human dimensions and values and their orientation towards the development of a humanistic approach, the components of the concept of green agro-production as a factor of competitiveness, sustainability, efficient and ecologically safe agriculture based on the use of a cross-cultural approach were analyzed.

Based on the systematic method of researching the green transformation of agro-production as the need to stabilize the basic position of agriculture, agro-production is considered as a complex system that includes many components, the study of which has become an important task of this article. System analysis and synthesis made it possible to analyze empirical facts about the specifics of the development of the green transformation of

agro-production and to show that the future of humanity and the survival of the planet stand under this concept. A number of systemic characteristics of green agro-production aimed at reducing the impact of agricultural activity on the environment, including reducing the use of chemical fertilizers and pesticides, as well as optimizing water use, were analyzed.

That is why green agro-production is considered as a complex system integrity, which consists of separate components that are interconnected and combined into a single, complete organism.

In some cases, the method of cross-cultural analysis is used to identify differences in the development of green agro-production, which uses more environmentally friendly production methods, which helps to reduce soil and water pollution and also contributes to the preservation of biodiversity.

The conceptual foundations of the research are provisions characterizing the meaningful nature of the research, which is based on the concept, theory, and paradigm of green agro-production, which can contribute to the development of rural communities, creating new jobs and local economic development. The research is based on methodological, theoretical and practical levels, which reflects the unity and interdependence of fundamental scientific approaches to the study of the problems in the formation of green agro-production as a factor of competitiveness and sustainability and their praxeological solution in the context of application in practice. The humanistic approach involves the use of a green economy, green management, and green ecotourism, which are developed on the basis of green agro-production, aimed at efficient and ecologically safe agriculture. [3]

## **4 Results**

### **4.1 Implementation of the green transformation of agro-production as a necessity to stabilize the basic situation of agriculture**

To date, there is no clear and unified definition of green agro-production, which should combine the requirements of the time and the peculiarities of agriculture. At the current stage, the concept of sustainable development of agro-production, which is ecologically clean and harmonious between man and nature, is emphasized more, therefore, sustainable development of agro-production has become a requirement of the time, which has attributes of public benefits and positive external effects. Green agro-production should be guided by the concept of sustainable development, supported by agricultural technology, green economy and green management, in order to promote the coordination of agricultural product safety, environmental safety, resource safety, and the improvement of integrated agricultural production, benefits and meeting the needs of the general public. The green transformation of agro-production is of great practical importance and relevance. At this stage, various food safety issues often arise, which seriously affect the daily lives of ordinary people. The basic status and indispensable importance of agro-production require us to pay attention to agriculture and pay attention to agriculture. Moreover, in today's global economic integration, the market for agricultural products also faces huge competition. Green agro-production should be more competitive on the world market.

The properties of the social product of agriculture and its positive external effects require that the development of agro-production be healthy and sustainable. Agro-production relies on requirements for agricultural products, which tend to be full-fledged, high-quality, non-toxic, ecologically clean and unpolluted products, which cannot be achieved through the development of agriculture. In order to compete and take a place in the international market, it is necessary to embark on the path of developing green agriculture and expand the scale of production using competitive advantages in both products and production costs.

The ecological highly profitable agro-production should be ecologically clean and sustainable modern agriculture. Thanks to good management methods and large investments in agricultural science and technology, it is possible to improve the comprehensive potential of agro-production and realize the high value of agricultural products.

Green agro-production is a modern approach to agriculture, which is directed at reducing the negative impact of agricultural activities on the environment and increasing production efficiency. [4]

In general, green agro-production has its advantages and disadvantages, and the choice between it and other methods of agro-production depends on the specific conditions, goals, and values of farmers and consumers. All of these factors must be carefully taken into account when considering whether to continue or transition to green agro-production, and they may vary depending on the specific conditions and region.

#### **4.2 The concept of green agro-production as a condition for a sustainable, ecologically safe and fair system of agricultural production, promoting human health and preserving nature**

The transformation in the mode of agricultural production and the dynamics of agricultural growth requires the formation of the concept of green agro-production. In traditional agriculture, it mainly relies on simple and small-scale mechanical production with labor intensity, which does not meet the requirements of modern agriculture. Firstly, it is the transformation of agricultural equipment. Different places have different areas and large differences in the types of agricultural production. Secondly, with regard to agricultural machinery, it is necessary to decide which machinery to choose according to local realities in order to adapt activities to local conditions. Moreover, depending on the economic situation of the farmers, financial subsidies should be provided in some aspects so that the farmers can replace the relevant equipment. Thirdly, there are innovations in agro-production. The green transformation of agro-production should encourage the development of agricultural growth caused by the use of land and agricultural materials, and the application of innovations in agricultural science and technology. The concept should rely entirely on research institutes, agricultural companies, and individual agricultural firms and corporations. Guided by green demand, the concept of green agro-production was created, based on the intensive transformation of agricultural production facilities. In the past, agricultural production was often a simple and extensive decentralized management, so land resources were not used properly. And in this mode of decentralized and disorderly management, each person in order to maximize their own interests, regardless of the overall development, various land resources have had problems over time.

**Table 1.** Advantages and disadvantages of green agro-production

No. in order	Advantages of green agro-production	Disadvantages of green agro-production
1.	Environmental sustainability: Green agro-production aims to reduce the impact of agricultural activities on the environment, including reducing the use of chemical fertilizers and pesticides, as well as optimizing water use.	Low yields: Green agro-production can result in lower yields compared to other agricultural production methods because it does not use synthetic substances that can increase yields.

2.	Soil conservation: Green agro-production helps preserve soil fertility and prevent erosion since it supports the natural cycle of nutrients in the soil.	High costs: Growing organic or eco-friendly products may require higher labor and crop maintenance costs.
3.	Consumer health: The production of organic products or products grown without harmful chemical fertilizers and pesticides promotes healthy consumption and reduces the risk of exposure to toxins on human health.	Limited availability: Green products and products may be more expensive for consumers due to higher production costs.
4.	Biodiversity conservation: Green agro-production contributes to biodiversity conservation since it often includes the creation of ecological corridors and the protection of natural environments.	Quality and safety challenges: In green agro-production, it is sometimes more difficult to control the quality and safety of the products, since they can be more vulnerable to harmful organisms and diseases.
5.	Environmental protection: Green agro-production uses more environmentally friendly production methods that help reduce soil and water pollution and help preserve biodiversity.	Higher cost of production: Organic products are usually more expensive to produce due to the use of more labor-intensive and less efficient production methods
6.	Reducing the use of chemical fertilizers and pesticides: Green agro-production emphasizes the use of organic and natural methods of plant protection, which can reduce the toxic effects of chemicals on the environment and human health.	Lower yields: Organic and green agro-production may have lower yields compared to standard methods of agricultural production
7.	Increasing resilience to climate change: Green agriculture promotes the development of methods that help crops adapt to climate change and worsening weather conditions.	Seasonality and imbalance of production: Some aspects of green agro-production may be more seasonal and imbalanced, which may require greater effort to ensure a stable supply of products.
8.	Improving the quality of products: Organic products, which are produced according to the principles of green agro-production, are usually considered tastier and more useful for consumers.	Limited availability: Organic and green products may be limited in availability to consumers due to their higher cost and limited market availability.
9.	Development of rural communities: Green agro-production can contribute to the development of rural communities by creating new jobs and contributing to local economic development.	High risk of yield loss: Organic crop production may be more prone to yield loss due to the absence of synthetic pesticides and herbicides.

Source: it is formed by the authors

Therefore, green agro-production must be transformed into large-scale production. According to the actual needs of the green transformation of agricultural production, the concept of green agro-production has to rationally regulate the relationship between the main part, including the relationship between producers and the market, the relationship between agricultural production and society, the economy and the environment. The government should play a leading role in establishing relations: firstly, the government should intelligently adjust the market order so that agricultural producers can fully and closely connect with the market and can receive the information they need from the market, so as to

improve agricultural production. The concept should adjust the relationship between agricultural production, ecology, and society. The function of agriculture is from the focus on the production of agricultural products to multifunctional production, life, and ecology. In addition, in the concept of green agro-production, great attention is paid to the ecological, cultural, and aesthetic functions of agriculture, while simultaneously adhering to the "three modernizations": 1) new agricultural functions are actively developing; 2) innovative formats of agricultural business are being introduced; 3) the integration of production and the new green agriculture are vigorously developing. [5]

**Table 2.** Component concepts of green agro-production aimed at efficient and ecologically safe agriculture.

No. in order	The component concepts	Content in the concept of green agro-production aimed at efficient and ecologically safe agriculture
1.	Sustainability of resources	Green agro-production sets itself the task of efficient use of natural resources, such as soil, water, air, and energy, with maximum preservation of their quality and productivity for future generations.
2.	Use of environmentally friendly methods and technologies	Green agro-production relies on the use of methods and technologies that minimize the use of chemical fertilizers and pesticides, promote biodiversity, and support soil and plant health.
3.	Organic cultivation of products	Organic cultivation of products is one of the main components of green agro-production. It requires the absence of synthetic chemicals and GMOs, compliance with environmental standards, and preservation of biodiversity.
4.	Water-saving methods	Green agro-production considers the importance of water resources conservation and the use of effective irrigation, water treatment and moisture management methods.
5.	Soil protection	Preserving soil fertility and preventing soil erosion is an important component of green agro-production. This includes the use of soil conservation methods and maintenance of its health.
6.	Preservation of biodiversity	Green agro-production supports biodiversity, including the restoration and maintenance of natural ecosystems that help control pests and maintain ecosystem services.
7.	Consumer education and support	An important component is consumer education concerning the benefits of green products and supporting consumers in their choices.
8.	Effective waste management	Green agro-production involves the use of waste management practices, including composting and recycling of agricultural waste.

No. in order	The component concepts	Content in the concept of green agro-production aimed at efficient and ecologically safe agriculture
9.	Development of sustainable agroecosystems	Green agro-production contributes to the creation of sustainable agroecosystems that are able to withstand stresses such as climate change, pests, and diseases. This may include crop rotation, crop succession, and other methods to maintain system sustainability.
10.	Minimization of greenhouse gas emissions	Green agro-production sets itself the task of minimizing greenhouse gas emissions caused by agricultural activities. This can include the use of alternative energy sources, reducing the use of mechanical processors, and optimizing transport.
11.	Development of the agricultural workforce	Green agro-production contributes to the creation of decent working conditions for agricultural workers and supports the development of rural communities.
12.	Use of scientific research and innovations	Green agro-production actively uses scientific research and innovations to continuously improve production methods and achieve greater productivity and sustainability.
13.	Promoting local markets and regional food security	Green agro-production supports the development of local markets and reduces dependence on food imports, thus contributing to regional food security.
14.	Considering the needs of rural communities	Green agro-production sets itself the task of considering the needs and wishes of rural communities, providing them with access to quality products and opportunities for self-development.
15.	Social, economic, and corporate responsibility	Green agro-production aims to achieve a fair and economically beneficial distribution of income and profits for all participants in the agricultural chain, including farmers, consumers and investors.

Source: it is formed by the authors

Thus, the concept of green agro-production is a comprehensive approach to agricultural activity aimed at ensuring sustainable development and minimizing the negative impact of agricultural activity on the environment. This concept includes various components and principles of green agro-production aimed at efficient and ecologically safe agriculture. and components are jointly aimed at achieving a balance between food production and preservation of the natural environment, ensuring the sustainable development of the agricultural sector and improving the quality of products for consumers. [6]

### 4.3 The concept of green agriculture as the basis of efficient and ecologically safe agro-production

Green agriculture as the basis of efficient and ecologically safe agro-production includes at least three levels of content:

1. Based on the concept of environmental sustainability, it aims to reduce the damage caused to the ecological environment by agricultural production (in particular, including the reduction of resource consumption, carbon dioxide emissions, soil pollution, and fertility



loss, etc.), and to implement environmental management and environmental recovery in agro-production.

2. Based on the concept of sustainable agricultural production, environmentally safe agro-production must effectively respond to environmental problems such as environmental pollution, soil erosion, climate change, biodiversity loss, and lack of natural resources to achieve sustainable agricultural development.

**Table 3.** Principles of the concept of green agriculture as a factor in the sustainable development of agro-production.

<b>No. in order</b>	<b>Components and principles of the concept</b>	<b>Content of the concept of green agro-production aimed at efficient and ecologically safe agriculture</b>
1.	Effective use of resources	Green agro-production is aimed at the rational use of land resources, water, fertilizers, and other materials to ensure the maximum yield with the minimum use of resources.
2.	Reducing the impact on the environment	The concept includes methods and technologies aimed at reducing soil, water, and air pollution, as well as preserving biodiversity.
3.	Use of environmentally safe methods	Green agriculture uses organic farming methods, natural fertilizers, and other environmentally safe practices to reduce the use of chemical pesticides and herbicides.
4.	Support of sustainability of ecosystems	The concept promotes the conservation and restoration of natural ecosystems such as forests, water resources and biodiversity.
5.	Consumer approach	Green agriculture is aimed at meeting the needs of consumers for high-quality and safe products.
6.	Cooperation with communities	Green agriculture promotes interaction between rural communities, farmers and other stakeholders to jointly achieve sustainable development.

Source: it is formed by the authors

3. Based on the concept of maximizing social benefits, maximizing the efficiency of agricultural production and economic benefits, as well as the production of high-quality agricultural products in large volumes, the concept of green agriculture can effectively solve the problems of food security, improve people's quality of life in the context of environmentally safe agricultural production. So, we can say that the concepts of green agriculture and ecologically safe agro-production are interconnected and influence each other. Based on this, green agriculture can be defined as a production model that considers the production and release of green products as the main goal, which integrates the concept of green production into all agricultural production and maximizes the comprehensive benefits of ecology, economy, and society based on ecologically safe agro-production. Investments in science and technology are necessary to achieve the above-mentioned goals. Therefore, the application of advanced production technologies and equipment, innovative

production models, and management methods in agricultural production is also an important element in the concept of green agriculture. [7]

The concept of green agriculture reflects the paradigm of sustainable development in agriculture, which is aimed at ensuring efficiency and environmental safety in agricultural production. This concept takes into account the needs of the modern agricultural sector and the importance of environmental protection. Green agriculture is an important direction for the development of agriculture in the context of preserving the environment and ensuring sustainable food production. This concept considers agriculture not only as a source of products but also as a system that must function in harmony with nature and with regard to the needs of future generations.

Ecological final agricultural products for final consumers. Green final agricultural products include ecologically clean agricultural products and agricultural by-products that meet the requirements of green agricultural production. Currently, a relatively complete standard for evaluating green agricultural products has been formed. By evaluating the environmental quality of the place of origin, production technology, product standards, packaging and storage, etc., green agricultural products can be divided into two grades: grade A and grade AA. The main category of "green" agricultural products is "green" food products, which can be divided into agricultural and forestry products and their processing products, livestock and poultry products, aquatic products, beverages, and other products. Thus, the materials of agricultural production include those necessary for the production of seeds, plant seedlings, fodder, chemical fertilizers, pesticides, reagents for various purposes, machines and equipment, etc. In the field, relevant enterprises produce and sell agricultural materials that meet the requirements of green agriculture. The technology of green agricultural production is the main element in realizing the benefits of the green agriculture model. The technology of agricultural standardization. In "green" agriculture, the relevant organizations receive income through the transfer of technology or services in the field of agricultural technology. Technologies that are directly used in the agricultural production process. Currently, the main functional categories include green agricultural raw materials (seeds, seedlings, etc.), environmentally friendly fertilizers for agricultural crops or feed for livestock and aquatic animals, green pest control or fight against biological diseases; green plant protection. [8]

## 5 Conclusions

Green agro-production should be guided by the concept of sustainable development, supported by agricultural technologies and green economy and green management, to promote the coordination of agricultural product safety, environmental safety, resource safety, and the improvement of integrated agricultural production. benefits and meeting the needs of the general public. Ecologically safe agro-production is the approaches and methods of agricultural production, which are aimed at ensuring high productivity and profitability of the farm, while minimizing the negative impact on the environment and preserving its resources for future generations. Environmentally safe green production is the fight against natural enemies, pest control, growing varieties that have high yields and resistance to pests and diseases, reducing the need for pesticides and herbicides; the use of organic production methods, such as the use of natural fertilizers, composting, cultivation without GMOs and chemical fertilizers; minimization of soil erosion, use of cover crops and other methods to preserve soil fertility; rational use of water resources, reduction of water consumption and water waste; preservation and restoration of natural ecosystems and biodiversity on farmlands; reduction of energy consumption and greenhouse gas emissions in agro-industrial production; use of secondary materials and waste to reduce emissions and pollution. Ecologically safe agro-production is aimed at ensuring sustainable and environmentally safe

food production, reducing the impact of agricultural activity on the environment, and preserving natural resources for future generations.

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