

Modern production and ecology: points of mutual understanding

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Abstract. The article is devoted to the consideration of the impact of the environmental factor on economic processes. It is noted that the ecological factor, reflecting the influence of environmental conditions on production processes, the use of minerals and other natural resources, land and water resources, atmospheric air, natural flora and fauna in the economic activities of enterprises, is of particular importance in modern economic conditions. The paper presents the main theoretical approaches to the significance of the development of ecological agricultural production in the conditions of increasing negative processes in the biosphere. The analysis of economic activity of the Russian enterprise concerning its ecological component on the example of LLC "Greenhouse Complex YugAgroHolding", located on the territory of the Chechen Republic is carried out. The necessity of active implementation of waste-free technologies and reuse of exhausted resources in production was substantiated. The importance of the development of ecologically oriented agricultural production with minimization of environmental impact was determined.

1 Introduction

Over the past 300 years, the terrestrial biosphere has shifted from predominantly wild to predominantly anthropogenic, crossing the 50% mark by the beginning of the 20th century. In the future, mostly terrestrial ecosystem forms and processes will become anthropogenic due to land use and other direct human interactions with nature. [1] Under the influence of powerful anthropogenic impact there is intensive pollution of the environment, destruction of natural ecosystems, disappearance of many species of flora and fauna, the consequences of disturbance of ecological balance are becoming more and more noticeable. At the same time, meeting the growing needs caused by the socio-economic development of society requires the involvement of more and more natural resources in economic turnover, which predetermines the increase of technogenic pressure on the natural environment and aggravation of the ecological situation.

2 Research methodology

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The purpose of this work was to study the processes of effective development of modern production on the example of the agricultural sector in accordance with the principles of environmental management and sustainable development. The methodological basis of the study was formed by the methods of system analysis, monographic method, method of comparisons.

Earl K. Ellis et al. in their work note that the anthropogenic transformation of the biosphere in the course of the industrial revolution occurred approximately equally through both the expansion of land use and intensification of land use.

Fomin A.A., Mamontova I.Y., studying the problems of the state of agricultural resources, emphasize the methods of sustainable agrarian production on the basis of intensive technologies.

Petrakov N.Y. and others focus in their work on the issues of modernization and economic security of Russia, pointing to the importance of the development of ecological agriculture, allowing, among other things, to reduce the degree of negative impact on nature.

The Concept of Transition of the Russian Federation to Sustainable Development notes the need for a consistent transition to sustainable development, which would allow a balanced solution of socio-economic tasks and problems of preserving a favourable environment and natural resources to meet the needs of both current and future generations of the Earth's inhabitants.

The national standard of the Russian Federation GOST R ISO 26000-2012. Group T50, considers social responsibility as an integral feature of a modern organisation, obliged to take into account social and environmental factors when making decisions, to be responsible to society and the environment for the results of its actions.

The State Programme for the Development of Agriculture and Regulation of Markets for Agricultural Products, Raw Materials and Food defines the goals, objectives and key areas of development and regulation of the Russian agro-industrial complex.

The Kommersant newspaper of October 2015 discusses the problems of the Russian agro-industrial complex, determining the need to strengthen state support for this sphere within the framework of project financing, taking into account regional specialisation.

The business plan for the greenhouse complex of YugAgroHolding LLC envisages the construction of a greenhouse complex for the year-round cultivation of protected vegetables in the amount of 7,187.62 tonnes.

The Federal Law on Environmental Protection in force in Russia is aimed at defining the legal basis of the state policy in the field of environmental protection in order to strengthen law and order and achieve environmental safety in the sphere of nature management.

3 Results and Discussions

An important branch of the economy for any state is agriculture in the form of a set of principles of socio-economic, organizational, technical and technological plan for the construction and functioning of production activities in certain conditions, with the aim of meeting the needs of society in agrarian products. The agrarian sector provides such vital products as basic foodstuffs and raw materials for the creation of consumer goods. About 80% of the population's demand for consumer goods is covered only at the expense of the agricultural sector. The level of agricultural development largely determines the living standards and welfare of the population of the country.

About 4750 million hectares of land are used for crop production and livestock development in the world, of which more than 1500 million hectares are under temporary and permanent crops, while permanent grasslands and pastures cover about 3300 million

hectares. Since 2000, the total area of agricultural land has changed slightly globally, but there is more land under permanent and irrigated crops, while under permanent grasslands and pastures there is much less. [2, p. 420]

The ongoing changes in the global climate necessitate changes in cropping patterns and management practices in the agricultural sector to adapt to changes in crop/land suitability. Agricultural systems are already trying to adapt to climate change through more precise use of technology and resources, and to a large extent these actions are driven by more complex demands from the global food system.

Under such conditions, as more factors of production are adopted, the importance of traditional indicators of land and water productivity is diminishing. This is evidenced by the fact that total factor productivity in the agricultural sectors has increased by 2.5% annually globally over the past few decades, indicating an increase in resource efficiency in this area, in the absence of adequate growth in agricultural land use and irrigated areas. [2, p. 421]

It should be noted that traditional agricultural production is characterized by a certain extensiveness. Due to the fact that the shortage of resources is becoming more acute, the application of ecological agriculture to develop a new theory of agricultural production and agricultural technology can contribute to the growth of resource efficiency, reduce the amount of waste generated and reduce the degree of negative impact on the environment. [3]

Agroecology, conservation and conservation agriculture, organic farming, agroforestry, agroforestry and organization of mixed crop-livestock farms have proven to be highly effective in practice as strategies leading to improved nutrition, healthier ecosystems and sustainable and resilient agri-food systems based on the principles of sustainable management of soil, water and biodiversity resources. [2, p. 421]

The concept of transition of the Russian Federation to sustainable development is a basic document reflecting the policy of the Russian state on a balanced solution of socio-economic problems and problems of preservation of favorable environment and natural resource potential of the planet for present and future generations of people. [4] To ensure future availability of resources, according to GOST R ISO 26000-2012, it is necessary, based on the capabilities of the Earth, to change the existing structure and volumes of consumption and production. [5]

In the modern world all conditions have been created to provide people with agricultural products all year round. To supply this agricultural products greenhouse complexes are created. Modern greenhouses are a complex of industrial buildings and structures that provide year-round production of vegetables and seedlings.

It should be noted that in recent years the greenhouse industry has been in the epicenter of attention of the Ministry of Agriculture of Russia as one of the underdeveloped agrarian industries in the country, but with great potential, backed by solvent consumer demand. In late 2013, the Government of the Russian Federation adopted the Program of support for agriculture, including subprograms to support the protected vegetable growing industry. [6]

Due to the introduction of a ban for Russia on food imports in 2014, measures to promote import substitution, including in the segment of production of non-seasonal vegetables and greens in the country, became most relevant. Obviously, the general price background, inflation rate and investment climate in the country's economy depended heavily on the reorientation of the Russian economy towards domestic production of scarce agricultural products. For large projects in the agro-industrial complex, compensation from the federal budget on costs (up to 25% of all investments) was assumed, which made new projects of large-scale greenhouse construction, in the words of the country's Minister of Agriculture, "...economically possible." [7]

In early October 2015, the Ministry of Agriculture made a statement about the intention to adjust the mechanism of state support for agribusiness in the direction of project

financing, taking into account regional specialization. Under the new format of support, no less than 30% of funds were to be allocated to new projects in the dairy, vegetable and fruit and berry industries. [7]

Accordingly, agro-industrial complex projects, even with limited possibilities of both federal and regional budgets, could count on priority support from the authorities. Co-financing could be provided to a greater extent for projects in those sectors where the share of prohibited imports was particularly high, which was stipulated by the importance of ensuring food security of the country. Protected vegetable growing belonged to such an agrarian direction and, accordingly, one could expect increased support from the state when creating projects of industrial vegetable greenhouses in the country. [7]

Industrial greenhouses competently designed and built according to modern technologies, equipped with an optimal irrigation system and the necessary special equipment, allow owners to receive high profits all year round. In the Chechen Republic, since 2015, the company YugAgroHolding Greenhouse Complex LLC, one of the largest in the region, has been active, growing more than 7,000 tons of vegetables per year. This organization is located on the territory of the city of Grozny. The facility was built with the direct support of the management and the Committee of the Chechen Republic, which provided an investment loan of RUB 1.76 billion. The agro-industrial complex was created within the framework of the National Project "Promotion of small and medium-sized entrepreneurship and individual entrepreneurship" as an event to provide privileged access to production areas and buildings for small and medium-sized businesses to create (develop) industrial and innovative enterprises. [8]

The main crops to be grown under the project are cucumber and tomato. The project was focused on Russia's largest greenhouse vegetable market in the Central and Southern region, where about 16% of the country's population lives in the regions closest to the production site. Most of the target end consumers of these products are residents of large and medium-sized cities.

The main buyers of these products as sales intermediaries, according to the order of decreasing priority, are represented by:

- retail chains;
- wholesale buyers (vegetable depots, small wholesale markets);
- local sales (small wholesale and branded stores). [8]

The operation of enterprises and other facilities that both directly and indirectly affect negatively the environment should be based on the environmental protection requirements noted by the Federal Law "On Environmental Protection" No. 122-FZ, which was adopted on August 22, 2004. [9] It is important to note that the greenhouse complex, presented as an object of industrial production, in its activities can have a negative impact on the environment both permanently and periodically. At the same time, according to the available nature protection norms, a certain impact of production on the environment is allowed. It is possible to reduce the degree of this negative impact through the transition to advanced technologies, greater consideration of economic and social factors.

Technical solutions that took place during the creation of LLC "TK YugAgroHolding", meet the requirements adopted in the Russian Federation within the norms of environmental, sanitary-hygienic, fire and other plan, the purpose of which is to create safe conditions for life and health of people in the operation of this facility, following the measures provided for in the project. [8]

This enterprise for the production of protected ground products uses new cultivation methods, which allow to significantly accelerate the payback period of the project due to the high yield of greenhouse crops. When producing vegetable products in the greenhouse complex, an integrated system of protection is applied, where the principle of biological regulation of harmful species becomes dominant. Methods of protection for different crops

can be determined by the species affiliation of pests and pathogens. And the more biological methods can suppress different species of diseases and pests, the more biological is considered to be the applied integrated system of plant protection.

Consequently, the place of biological methods in integrated plant protection depends on the crop to be protected and is based on the release of only certain species of entomophages and microorganisms against pests and diseases of a given vegetable crop. It is necessary to proceed from the fact that factors of external influence on biological agents are rather easier to control in a limited area of protected soil. Integrated system of plant protection against diseases and pests in greenhouses consists of a complex of quarantine, preventive, agrotechnical, sanitary-hygienic and biological measures.

Obtaining high quality products, i.e. ecologically safe in conditions of preservation of biological diversity in the biocenosis acts as the main goal of activities to achieve biological protection of cultivated crops. Biological protection of plants should be considered not as destruction of harmful species, but rather as works on regulation of their numbers, i.e. biological control with the following methods:

- finding single individuals of pests or initial signs of plant disease;
- a single introduction of a biological agent for reproduction and its further functioning as a regulator of the number of pest organisms;
- for the purpose of operational containment of harmful species, repeated release of various biological agents;
- realization on production areas of preservation, activation and accounting of activity of useful species of entomophages.

Biological system of protection is based on non-pesticide technology of cultivation of crops and it should be considered as a set of measures of protective nature, with the active use of resistant varieties and hybrids, weekly carrying out a continuous survey of plantations, releasing entomophages and using biopreparations, thereby achieving the possibility of biocenotic equilibrium.

It should also be noted that due to the successful geography of the project in the 7 light zone and in a region with mild winters, the cost of energy and electricity at the enterprise is much lower than the vast majority of industrial greenhouses in more northern areas of Russia. A continuous production cycle based on light-culture with the use of modern agrotechnologies and selective hybrids makes it possible for the complex to produce extraordinarily high yields all year round by Russian and, especially, Chechen standards.

The technology of growing vegetable plants on nutrient solutions using the low-volume method makes it possible to reduce vegetable production costs by 30-40% and increase yields by 30-50% compared to conventional technology.

Mineral wool mats are used as a substrate for growing vegetable crops, which is a clean and sterile material. Substrate made of lime mineral (mineral wool mats) is characterized by increased buffering, has excellent ability to absorb and retain moisture, providing an optimal level of watering for plants, is clean from plant pathogens and pests. The mats are saturated with nutrient solution at least 72 hours before placing seedlings. Mat packaging is labeled according to the template and holes are cut according to the size of the cube. Arrow-shaped pegs with microtubing are installed in the holes.

In the low-volume method for growing plants, which is used at this plant, a substrate is applied to one plant in a volume of up to 5 liters, and the necessary uniform moistening is also carried out with a drip irrigation system over the entire volume. Due to the fact that the volume of substrate for the root system of growing plants is small, in addition, it is chemically neutral, water and nutrients are supplied within a certain irrigation scheme. When growing plants based on the low-volume method, drip irrigation is considered as the main method of irrigation. The nutrient solution required by the plants is delivered evenly to the plastic racks from below via a tidal flow system. The substrate, which is highly

porous and water-absorbent, is saturated with the nutrient solution. After a certain time, determined by the established irrigation program, the remaining nutrient solution goes through the drainage collection system to the "drain", then the drainage, having passed cleaning and disinfection, returning to the system of nutrient solution preparation, is used again.

For modern technologies of vegetable crops production it is necessary to maintain active microclimate regimes in greenhouses for the processes of photosynthesis of plants and for obtaining consistently high yields. Automation of microclimate control systems allows to save up to 15-25% of heat resources, effectively apply CO₂ fertilization of plants, form an active microclimate in the greenhouse to achieve intensive growth of vegetable crops and their yields, create attractive and favorable working conditions for the staff, significantly increase the overall culture of production. [8]

Location in the suburbs of Grozny provides LLC "TK YugAgroHolding" minimal logistics costs for the supply of fresh vegetables, i.e. products of its own production and fresh products for the region. Well-developed logistic flows of fresh vegetables from the Chechen Republic, organized by wholesalers of the North Caucasus region, also provide an opportunity for the organization to export surplus of its fresh products to remote regions of the country. [10]

Within the ecological agricultural sector, there are more stringent requirements for pest and disease control and the use of chemical fertilizers. The combination of biotechnology, physical and chemical control means allows to significantly reduce the damage caused to the environment by chemical substances, to reduce the impact on water sources and soil pollution, as well as to reduce the amount of resources consumed for production. New agricultural production technologies such as drip and sprinkler irrigation technologies provide an opportunity to rationally use water resources and increase the efficiency of their application. Ecological agricultural technologies also make it possible to use less labor, thus contributing to the growth of incomes in this area.

4 Conclusions

In conclusion, we would like to note that agriculture is a priority sector of the Russian economy, as it is aimed at ensuring food security of the country. The most important task in the conditions of import substitution is not only the active development of domestic agriculture, but also the competitive on the world market of the entire agro-industrial complex. The agricultural sector is among the few fast-growing areas of the Russian economy, which is practically the only one that has been actively developing even during the crisis years. Agriculture is becoming a driver of development of other sectors of the economy, demonstrating sustainable growth and outstripping development of the entire agro-food complex of the country.

Active application of advanced agricultural development systems on different landscapes and in different social conditions for the production of certain products, employment, full and sustainable nutrition of the population, makes it possible to save resources, preserve ecosystems, less greenhouse gas pollution of the atmosphere, etc.

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