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Амонс С.Е.,
кандидат сільськогосподарських наук,
доцент кафедри ботаніки, генетики та захисту рослин,
Вінницький національний аграрний університет
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ЕКОЛОГО-ЕКОНОМІЧНІ ОСНОВИ ВИРОБНИЦТВА ПРОДУКЦІЇ ОВОЧІВНИЦТВА В УКРАЇНІ

Amons S.E.
Candidate of Agricultural Sciences, Associate Professor,
Associate Professor of the Department of Botany, Genetics and Plant Protection,
Vinnitsia National Agrarian University

ECOLOGICAL AND ECONOMIC ASPECTS OF VEGETABLE PRODUCTION IN UKRAINE

Анотація.

У статті розглянуто еколого-економічні основи виробництва продукції овочівництва в Україні, наголошено, що вирішення проблеми ефективного функціонування підприємств галузі овочівництва має низку економічних, соціальних та екологічних наслідків і для самих підприємств, і країни в цілому. Тому однією з центральних проблем української аграрної економіки є підвищення ефективності виробництва овочів.

Доведено, що надзвичайно важливою умовою підвищення продуктивності, обсягів виробництва, якості і безпеки овочів є перехід галузі на адаптивну основу. В адаптивному овочівництві для підвищення родючості ґрунтів перевага віддається широкому використанню біологічних факторів (біологічний азот, всі ресурси екологічно безпечних органічних добрив та ін.), передовим агротехнічним прийомам вирощування.

Abstract.

The article considers the ecological and economic bases of vegetable production in Ukraine, emphasizes that solving the problem of efficient functioning of enterprises in the vegetable industry has a number of economic, social and environmental consequences for the enterprises and the country as a whole. Therefore, one of the central problems of the Ukrainian agricultural economy is to increase the efficiency of vegetable production.

It is proved that an extremely important condition for increasing productivity, production volumes, quality and safety of vegetables is the transition of the industry to an adaptive basis. In adaptive vegetable growing to increase soil fertility, preference is given to the widespread use of biological factors (biological nitrogen, all resources of environmentally friendly organic fertilizers, etc.), advanced agronomic methods of cultivation.

Ключові слова: *овочі, овочівництво, виробництво, продукція, економіка, екологія, ефективність.*
Keywords: *vegetables, vegetable growing, product, production, economy, ecology, efficiency.*

Introduction.

Vegetable plants are the ancestors of agriculture. Most of their species were introduced into the culture in the areas of ancient civilizations and have more than one millennium. They were used in food, used for treatment and as a dietary food, sometimes as ornamental plants.

More than a quarter of a million species of plants are known worldwide, of which 30,000 are edible, and 7,000 of them are used as food. However, on a large scale, humans grow only about 120 types of plant foods, of which only 9 types of vegetable crops provide more than 75% of plant foods.

Vegetables play a huge role in human nutrition. The nutritional value of vegetables is determined by the content of carbohydrates, organic acids, mineral salts, vitamins. Vegetables contain various aromatic and coloring substances that determine their specific aroma and appearance. The peculiarity of the chemical composition of vegetables is their high water content and small amount of nutrients (proteins, fats and carbohydrates); the caloric value of most vegetables is low.

According to the Worldwide health care organization recommendation, the amount of vegetables and fruits in the diet of each person should be at least 400 grams per day. A person should eat at least 400-500 g of vegetables daily, which can satisfy 20-35% of the need for protein, 70-80% - in carbohydrates, 70-90% in mineral salts, trace elements and vitamins [1].

Vegetable growing is one of the oldest branches of agriculture. Growing cabbage, cucumbers, and onions has more than 4 thousand years. About 2,000 years ago, carrots, beets, radishes, and garlic were introduced into the culture. Vegetables are grown everywhere - from the northern border of agriculture to the tropics. Such a wide distribution is due to high nutritional and taste qualities and their importance as a source of vitamins [2].

Of all the branches of agriculture, the vegetable industry is developing most dynamically, due to the high economic and social importance of vegetable production for the world economy. Gross vegetable production in the world reaches more than a billion tons per year. The annual growth of vegetable products is 70-80 million tons. No other branch of agriculture is developing at this rate.

However, due to their widespread consumption, fresh vegetables can be suppliers of major chemical and biological contaminants dangerous to human health, which include: toxic elements, radionuclides, pesticides, nitrates and a number of microbiological indicators. The sources of pollution can be soil, air, water, fertilizers, pesticides and others. In this regard, in the context of increasing globalization of the market of goods and services, the issue of increasing the requirements for quality and safety of fresh vegetables should be given special attention [3].

The development of a market economy in Ukraine involves the implementation of significant technical and organizational changes in vegetable growing. At the industry level, preference should be given to modern technologies that provide energy and resource saving, reduce living costs and product losses, prevent environmental pollution, and increase soil fertility.

Now there is an urgent need to develop a model of institutional support for the development of the organic vegetable market, which would contribute to effective action, which would support the health of soils, ecosystems and living organisms.

Formulation of the problem.

According to FAO and OECD estimates, as a result of growth in per capita income, by 2050 global agricultural production should increase by 60-70% compared to 2000, which will mean the need to produce an additional 940 million tons of grain and 200 -300 million tons of meat per year.

At the same time, the average annual growth of agricultural productivity is expected to be below 1.7% and according to existing forecasts will decrease if there is no active introduction of radical technological innovations. The growth rate of the world's population is 1.13%, the average food consumption per capita is increasing [4].

Ensuring economic growth is currently associated with a steady increase in pollution and environmental degradation, a significant reduction in natural resources, imbalances in the biosphere, climate change and other adverse effects of active human intervention in natural processes.

The scale of anthropogenic impact is such that a significant part of land, including agricultural land, is in unsatisfactory condition due to various negative processes and phenomena: reduction of soil humus content, water and wind erosion, compaction, salinization, flooding, desertification, acidification, industrial emissions, petroleum products, radionuclides, due to waste storage etc.

Land degradation causes huge economic losses to world agriculture, disturbing the ecological balance and worsening the economic and social conditions of human life. Estimates of economic damage from land degradation for developing countries range from 1 to 7% of GDP per year.

Large-scale intensification of agricultural production has led to a reduction in the resource potential for further development due to agrochemical pollution and soil erosion. According to the FAO, about 25% of the world's agricultural land as of 2011 was assessed as severely degraded, and another 46% - as moderately or slightly degraded. In addition, the intensification has caused a number of other problems associated with the reduction of natural biodiversity, depletion of groundwater aquifers, the spread of forms of pests and pathogens resistant to modern pesticides [5].

Most major agricultural measures, such as chemicalization of agriculture and land amelioration, which are powerful means of increasing the productivity of fields, which account for more than half of the increase in yield, at the same time contribute to environmental pollution. To preserve and increase soil fertility in Ukraine, it is necessary to increase the application of mineral and organic fertilizers, as well as the introduction of technologies of adaptive landscape agriculture. It is also important to increase the responsibility of owners and tenants for preserving the potential of agricultural land, strengthening environmental control and supervision in agriculture.

According to experts, agriculture is one of the industries that will be most sensitive to climate change. The expected effects of global warming are generally significant and negative for farmland yields and agricultural productivity, but are differentiated by regions of the world. An acute problem is the shortage of water for irrigation, which is characteristic primarily of tropical countries.

Another global problem is the spread of pests and diseases to new areas. Global warming is changing natural conditions in many areas, making them habitable to heat-loving / moisture-loving pests and pathogens. This all leads to new economic risks for agribusiness, leading to the transformation of the cost of adaptation to natural factors from "predictable conditional" to "poorly predictable" variable costs [6].

Increasing demand from agriculture and other sectors of the economy leads to a struggle for water resources, which, in turn, has a negative impact on the environment and causes social and economic tensions.

In areas with unstable rainfall, where further development of water systems is not possible, agricultural production will be constrained more by water scarcity than by land availability.

The issue of utilization of pesticide residues remains an urgent problem to this day and more questions and problems arise in connection with the intensification of agriculture and increasing the use of mineral fertilizers, pesticides, which is manifested in increasing nitrates in groundwater, increasing nutrient removal substances by surface waters, increasing the risk of pesticide residues in food and their impact on public health.

Agricultural production, despite some positive changes in the country's agricultural economy, continues to experience serious economic difficulties. Most agricultural enterprises are characterized by a low level of production efficiency, which is largely due to the lack of parity in the intersectoral price mechanism and lack of funds to improve the condition of agricultural land, their rational and efficient use, preservation of the environment.

Therefore, solving the problem of efficient functioning of vegetable industry enterprises has a number of economic, social and environmental consequences for the enterprises and the country as a whole. One of the central problems of the Ukrainian agricultural economy is to increase the efficiency of vegetable production. To achieve this goal, it is necessary to solve the main task - to choose the most rational way to apply the factors of production to resolve the contradiction between growing needs and lack of resources to meet them.

The purpose of the study is to analyze the state of the vegetable industry in Ukraine, as well as coverage and solution of ecological and economic bases of vegetable production. The object of study is the economic and environmental aspects that affect the production of quality and safe vegetable products.

Analysis of recent research and publications.

Scientific works on the theoretical and methodological foundations of the effective functioning of the vegetable industry were investigated by V.G. Andriychuk, O.S Bondar, B.V. Gubsky, A.V. Gushcha, B.P. Dmitruk, V.A. Halchynska, R.V. Lohosha, T.V. Kucherenko, M.F. Kislyachenko, V.P. Rud, O.V. Ulyanchenko and others.

However, the issues of covering the ecological and economic bases of vegetable production in a market environment, modern forms of agro-industrial integration and increasing the efficiency of the industry were not sufficiently covered. These issues need further studying.

Research methodology.

In studying the issues of coverage of ecological and economic bases of vegetable production, the works of domestic and foreign scientists, primary materials of the author's own research, periodicals were studied. Monographic, statistical and economic, computational-constructive, abstract-logical and other methods were used as research methods.

Results of the research.

In recent decades, the intensification of agriculture has led to some negative consequences. The most important reason that leads to the deepening of the process of land degradation, the deterioration of the environmental situation lies in the desire of the farmer to get the most out of the land. Agriculture faces two main challenges: on the one hand, the world's growing population must continue to be provided with sufficient food, that is why agriculture must become more productive.

On the other hand, the increase in agricultural production is one of the factors of negative impact on the environment. So, as an alternative, agriculture should produce more environmentally friendly products. This raises the problematic question of how to solve these contradictory goals arising from tasks of agricultural production for the development of sustainable agricultural and food systems, both in Ukraine and around the world [7].

According to the State Statistics Service of Ukraine for the last 7-8 years the level of consumption of vegetables and food melons by the population has been set at 163-167 kg per year per person, which corresponds to the national norms of rational nutrition (161 kg). For comparison, in developed European countries, vegetables and greens are consumed up to 285 kg per person, which is almost 120 kg more than in Ukraine [8].

The formation of the domestic market of vegetable products of the country is due to its own production (Table 1).

A feature of modern vegetable growing was the reduction of production by large farms and the expansion of vegetable crops on homesteads, cottages and in peasant (farmer) farms while simultaneously and significantly reducing it in agricultural enterprises. A feature of modern vegetable growing was the reduction of production by large farms and the expansion of vegetable crops on homesteads, cottages and in peasant (farmer) farms while simultaneously and significantly reducing it in agricultural enterprises.

Vegetable growing areas in 2019 decreased by 12 thousand hectares, but the yield of vegetable crops increased by 36.2% compared to 2005, which in turn increased the gross harvest of vegetables by 2393 thousand tons (32.8%). In households, the gross production of vegetable products in the 2019 marketing year also increased. The level of profitability of vegetable production over the past 5 years has significantly decreased and amounted to only 2.8%.

The largest share in the structure of vegetable crops is traditionally occupied by tomatoes and cabbage, which is about 25% and% and 18%. Also significant areas in the cultivation of vegetable crops belong to onions, carrots and beets.

Table 1

Dynamics of vegetable production in Ukraine

Indicators	Years							Deviation 2019 to 2005	
	2005	2010	2015	2016	2017	2018	2019	+/-	%
Collected area, thousand hectares	464,0	468,0	447,0	447,0	446,0	440,0	452,0	-12,0	97,4
Yield, c / ha	157,1	207,8	206,1	210,5	207,9	214,3	214,0	56,9	136,2
Gross production, total, thousand tons	7295,0	8122,0	9214,0	9415,0	9286,0	9440,0	9688,0	2393	132,8
incl. - enterprises	787	964	1282	1323	1344	1357	1421	634	180,6
- households	6514	7158	7935	8092	7942	8083	8267	1753	126,9
Share of vegetable production,% of total	89,3	88,1	86,1	85,9	85,5	85,6	85,3	-4,0	95,5
Production of vegetable crops per person, kg	155	177	215	221	219	223	231	76	149,0
The level of profitability of production,%	36,7	31,4	32,0	15,3	9,9	13,3	2,8	-33,9	x

Source: [8]

The stability of domestic production is a guarantee of food security of the state and according to FAO own production for food purposes should be in the range of 80-85%, imports 15-20% and exports 15-20% (Table 2).

Table 2

Dynamics of the actual capacity of the domestic vegetable market and self-sufficiency in food, thousand tons

Indicators	Years							Deviation, (%) 2019 to 2005	
	2005	2010	2015	2016	2017	2018	2019	2005	2018
Actual capacity domestic market	7556	8849	9675	9910	9406	9694	10273	36	6
Own production	7606	8873	9792	9998	9721	9940	10244	35	3
Imports	100	311	95	136	129	188	313	у 3,1 рази	66
Export	150	335	212	224	444	434	284	89	–35
Consumption fund	5663	6581	6890	6984	6783	6927	6924	22	0
Other internal use	1697	2290	2877	2853	2662	2689	2898	71	8
Self-sufficiency,%	103	100	100	102	103	103	104	x	x

Source: [9]

During the study period, exports increased by 89%, although in total production on exports of vegetable products account for a small share of 3-5%. There is a clear trend to increase imports (3.1 times by 2005, by 66% by 2018) due to the supply of greenhouse vegetables in the off-season, greens, exotic vegetables and vegetables, the demand for which in some periods is not covered by domestic producers.

Thus, about 90% of the gross vegetable harvest is provided by households, so a set of issues needs to improve the system of sales of vegetable products and the development of new forms of management, the formation of specialized cooperative vegetable farms, sales cooperatives, which will ensure a more even supply of vegetables throughout the year in a certain range, will strengthen the influence of the household sector on the stabilization of the vegetable market in Ukraine.

Ukraine is one of the countries with the highest volume of generation and accumulation of industrial waste. According to the State Statistics Service of Ukraine, about 100 million tons of harmful substances enter the soil, water and atmosphere every year, and Ukraine has the status of an ecological disaster zone, obtained as a result of the Chernobyl accident.

Man-caused impact on the state and development of agricultural ecosystems requires the solution of the problem of developing methods and techniques to prevent or reduce the negative impact of environmental factors to ensure sustainable development of agricultural production.

Currently, the agricultural sector faces one of the most important tasks, which is related to the production of quality and environmentally friendly food for the population. This issue is especially relevant for the production of vegetable products. Improving product quality largely determines the survival of the enterprise in market conditions, ensuring, as a rule, higher incomes from production and marketing activities.

The authors [10] believe that the main stages of the ecological and economic condition of agricultural enterprises should be: first, it is an assessment of the impact of their activities on the environment; secondly, it is the formation, implementation and improvement of environmental policy of the enterprise; thirdly, moni-

toring and evaluation of the effectiveness of environmental management; fourth, it is the integration processes in the management system of the environment and the quality of products produced by the agricultural enterprise.

According to Levkin R.V. efficient production of vegetable products makes it possible to balance a person's diet and provide it with the necessary vitamins, amino acids and volatile acids. The main is the quality of vegetable products, its environmental friendliness and safety for the environment, which is a major factor in the competitiveness of agricultural enterprises [11].

Natural resources are in demand in the agricultural economy. The stability of agricultural production, quality and safety of products, raw materials and food directly depend on their ecological condition. Consider in detail what environmental factors within the country affect to the quality of vegetable production. In modern conditions, there are two blocks of problems in the relationship between agriculture and ecology. The first block relates to the negative impacts on agriculture, industry, transport and other sectors of the economy.

Among all the natural components one of the most contaminated is soil. The main factors of soil contamination are heavy metals and pesticide residues. Mutagenicity caused by environmental pollution impairs human health, its hereditary basis. Pollution of the environment occurs as a result of economic activity of agricultural producers.

Wind and water erosion of soils, which is largely caused by violations of agronomic rules of tillage in the cultivation of agricultural products - have an extremely negative impact on agricultural areas. Due to the lack of effective anti-erosion protection in Ukraine, more than 800 million tons of soil or 26 million tons of humus are lost annually on agricultural lands, which contains 1.2 million tons of nitrogen, 0.9 - phosphorus and 13.9 million tons of potassium [12].

Manifestations of wind and water erosion of soils lead to losses of humus, nutrients on agricultural lands, therefore is a key factor that reduces their production efficiency and negatively affects the overall efficiency of the crop industry (Table 3).

Table 3

Annual economic losses from soil erosion in Ukraine

Losses	Loss of relatively net income	
	million dollars USA	%
Direct - total	565	22,5
including from: water erosion	246	9,8
deflation	319	12,7
Shortage of harvest	1695	67,5
Other types (10%)	251	10,0
Together	2511	100,0

Source: [13]

The high level of air pollution in the country is determined mainly by emissions from enterprises for the production and distribution of electricity, gas and water, processing, transport and communications, and a number of others.

The spatial distribution of emissions reaches tens of kilometers. Despite the favorable natural and climatic conditions for the dispersion of pollution in the atmosphere due to the plain landscape and favorable wind roses, there are frequent calm, anticyclonic type of weather, leading to an increase in environmental pollution.

There is practically no industrial facility in Ukraine, as a result of which the concentration of major pollutants does not exceed the maximum allowable values. Today, there are about 10,000 facilities of potentially increased environmental and man-made danger. Only 15 percent of urban residents live in conditions of low air pollution, 52 percent – in moderate, 24 percent - in heavy and 8 percent – in extremely heavy pollution [11].

The impact of the transport complex on the environment is expressed to a greater extent by the increase in the number of road transport, especially buses and cars. The main sources of toxic substances (carbon monoxide, hydrocarbons, sulfur oxide, nitrogen oxide and particulate matter (dust, soot)) are caused by the operation of road transport. Road construction also disturbs the ecological balance in nature, as it leads to landscape change, increased water and wind erosion, landslides, pollution of the surrounding area.

It is also necessary to highlight the problem of increasing the volume of solid waste generation, the imperfection of the system of collection, accounting for formation and accumulation. According to various indicators, from 700 to 800 million tons of waste are generated annually on the territory of Ukraine. The total amount of waste accumulated on the territory of Ukraine exceeds 30 billion tons, including harmful (toxic) - 2.9 billion tons [14].

The ecological situation is aggravated by the insufficiency of the existing system of green plantations. Territorial lack of greenery is accompanied by uneven distribution of settlements. To solve this problem, it is necessary to provide a system of greenery that forms the so-called filter. Attention should be paid to creating a sufficient in terms of parameters and quality of the forest park belt, which can serve as a reservoir of clean air.

In order for the environmental costs to be justified and effective, it is necessary to forecast the level of environmental costs in the country as a whole and for individual elements of its economic complex, taking into account the planned growth rate of production. It is worth emphasizing on the development of measures to strengthen territorial organizational structures operating in the field of environmental protection, the development of environmental monitoring, the expansion of

environmental control of industries and activities, including potentially dangerous.

The second block of problems is related with agriculture. The complex impact of agriculture on the environment consists of a large number of factors influencing crop production and animal husbandry in relation to the peculiarities of the location of regions in a particular geographical area.

Different types and forms of mineral fertilizers used in crop production have different effects on soil properties. A significant shortage of such fertilizers includes the presence of heavy metals (cadmium, lead, nickel, etc.). As for organic fertilizers, the fields for vegetable crops have stopped fertilizing, and this despite the fact that organic fertilizers are more environmentally friendly than mineral.

The role of fertilizers is very important for the intensive development of production, but an overdose of these substances can adversely affect the quality and safety of products produced for food supply.

The content of fertilizers, pesticides in the soil and local contamination of soils with salts of heavy metals and other toxic substances often exceeds the maximum allowable concentration, which negatively affects the existence of agricultural plants, including vegetables.

Agricultural production is a source of air pollution. The air near livestock complexes has a specific smell and contains ammonia in high concentrations. Toxic products enter in water bodies from the atmosphere and pollute it within a radius of 20 km from a large livestock complex. A special place in agriculture is occupied by the problem of livestock and poultry waste. Almost all poultry farms take out garbage in the middle of the field, which pollutes arable land, groundwater sources, air, harming the environment and the health of the rural population.

An extremely important condition for increasing productivity, production volumes, quality and safety of vegetables is the transition of the industry to an adaptive basis. In adaptive vegetable growing to increase soil fertility, preference is given to the widespread use of biological factors (biological nitrogen, all resources of environmentally friendly organic fertilizers, etc.), advanced agricultural techniques (proper tillage, scientifically sound vegetable crop rotations, etc.).

In the case when there is a lack of agrochemical conditions necessary for the formation of the planned harvest and the creation of favorable for the beneficial soil microflora, the amount of nutrients should be compensated by the use of mineral fertilizers. Types and forms of mineral fertilizers, chemical ameliorants, doses, terms and methods of application are set taking into account the biological requirements of vegetable crops, their varieties and hybrids, planned harvest, environmental and economic requirements, results of comprehensive soil fertility monitoring and operational monitoring during vegetable growing season.

With regard to reducing the negative impact of livestock complexes on the production of cleaner vegetable products, it should be taken into account placing such facilities in agriculture and passing the assessment of environmental impact.

The future of agriculture and the ability of the global food system to guarantee food security for the world's growing population are closely linked to the improvement of natural resource management. Serious reforms and investments are needed in all regions to address the growing scarcity and degradation of land, water and biodiversity and the additional pressures arising from rising incomes, climate change and energy needs.

It is necessary to create the right incentives for the use of environmental agricultural services to protect catchments and biodiversity and ensure that food production uses sustainable technologies [15].

The development of vegetable growing in Ukraine must be carried out by deep intensification of production with the widespread introduction of innovative approaches, modernization of material and technical base. Lohosha R.V. believes that an important area of innovative development of the vegetable industry is irrigation of vegetable crops, which are quite moisture-loving. In the structure of agricultural production in Ukraine, the leading place in terms of economic efficiency and environmental safety is occupied by drip irrigation.

It is more economical not to apply irrigation, but at the same time to apply a solution of fertilizers with irrigation, thus carrying out accurate dosing and control of all nutrients. Vegetable crops are differently occupied by additional total investments related to irrigation [16].

At present, Ukraine, unfortunately, is mainly only an importer of modern technologies and innovations in vegetable growing, due to the practical absence of its own vegetable seed production and the actual minimization of its role in the modern development of domestic vegetable growing, therefore Ukraine can not compete successfully with producers of vegetable products in such conditions.

However, the introduction of modern hybrids and varieties of vegetable crops of foreign selection, and intensive technologies for their cultivation over the past 20 years has significantly increased yields and quality of vegetable products, which allowed Ukraine to produce quality products that meet both domestic demand and opportunity to be competitive in the world food market.

According to the State target program for the development of vegetable growing for the period up to 2025, it is planned to meet the needs of the state in high quality vegetables and products of their processing; to increase the efficiency and competitiveness of vegetable growing by providing the population with high-quality, affordable products; to increase the share of enterprises engaged in vegetable production, including family farms, agricultural cooperatives in gross production to 30 percent, to create appropriate specialized clusters; rational use of land resources, preserve and reproduce soil fertility [17].

Thus development of vegetable growing in the state needs to be carried out by deep intensification of manufacture with wide introduction of innovative approaches, modernization of material and technical base and preparation of experts of new formation.

The priority should be to solve the following tasks:

- promotion and wide introduction of innovative technologies to increase the production of vegetable products;

- providing processing enterprises of the industry with raw materials for vegetable canning;

- stable year-round supply of ecologically clean vegetable products to the population of the country.

Based on this, the economic development of vegetable growing is possible only through the revival of industrial vegetable growing, the creation of a network of large vegetable enterprises. Small producers have almost exhausted the reserves of their development, both in the direction of increasing the area and the introduction of modern equipment and technologies. They need to look for new approaches and directions in the development of vegetable growing to increase the profitability of production, but this involves additional costs.

The current environmental situation in the country has a significant impact on the quality of vegetable products. Therefore, a more detailed, careful consideration of the issues of rational use of the territory, formation of ecological infrastructure, improvement of the urban environment is necessary.

To provide the population with environmentally friendly products, it is necessary to place agricultural production in such a way that the negative impact of the environment is minimized. Due to the implementation of scientifically sound measures in the agro-industrial sphere, it is possible to achieve economically justified and practically significant reduction of the supply of chemical toxic substances in vegetable products. Ensuring the production of products that meet environmental standards in contaminated areas is extremely important for maintaining the infrastructure of rural areas and creating a prosperous social environment.

Conclusions.

The research identified a number of problems in the development of vegetable growing, due to the impact of the environmental situation in the country: the presence of enterprises with emissions of pollutants exceeding the maximum allowable values; excessive application of mineral fertilizers; air pollution by toxic products of livestock complexes.

Modern methods of agriculture lead to a number of acute environmental problems, their successful solution is possible only on the basis of rational use of nature, the use of organic production methods, the implementation of a comprehensive system of nature protection and productivity of agriculture and livestock.

To reduce the negative impact of agricultural production on the environment, the state must apply a set of measures of both environmental and economic nature, stimulate the spread and introduction of biotechnology, technical modernization of enterprises. The problems connected with livestock waste need strict regulation, especially for industrial farms. It is necessary not only to carry out their safe utilization, but also to use them rationally for the needs of the national economy.

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