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MODERN SITUATION AND PROSPECTS OF THE USE OF BIOTECHNOLOGIES IN THE DEVELOPMENT OF AZERBAIJAN'S AGRICULTURE

SITUACIÓN MODERNA Y PERSPECTIVAS DE LA UTILIZACIÓN DE LAS BIOTECNOLOGÍAS EN EL DESARROLLO DE LA AGRICULTURA DE AZERBAIYÁN

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ABSTRACT

This work aims to briefly discuss the current situation and the main problems of biotechnology development in agriculture in Azerbaijan. To this end, the perspectives on the use of biotechnology in products produced in the country's agro-industrial complex are mentioned, highlighting the advances made in this field. Currently, the use of biotechnology in the country acts as a means to guarantee food security and optimize negative effects on ecosystems. Thanks to the application of biotechnologies, productive plant species, and animal breeds are created that are resistant to the effects of natural-geographic factors and diseases. The development of these plant and animal species helps ensure production efficiency, restore degraded soils and significantly reduce the need for pesticides and mineral fertilizers. Taking this into account, in recent years the legal basis has been formed in the Republic of Azerbaijan for major works aimed at the production of agricultural products in the newly created and planned agroparks, as well as to increase their export potential and the acquisition of new productive varieties for this purpose.

Keywords: Agriculture, Agroindustrial complex, Biotechnology, Genetic engineering, Agroparks.

RESUMEN

El objetivo de este trabajo es discutir brevemente la situación actual y los principales problemas del desarrollo de la biotecnología en la agricultura de Azerbaiyán. Para ello se mencionan las perspectivas del uso de la biotecnología en los productos elaborados en el complejo agroindustrial del país, destacando los avances realizados en este campo. Actualmente el uso de la biotecnología en el país actúa como un medio para garantizar la seguridad alimentaria y optimizar los efectos negativos sobre los ecosistemas. Gracias a la aplicación de biotecnologías se crean especies vegetales productivas y razas animales resistentes a los efectos de factores y enfermedades natural-geográficas. El desarrollo de estas especies vegetales y animales ayuda a garantizar la eficiencia de la producción, restaurar suelos degradados y reducir significativamente la necesidad de pesticidas y fertilizantes minerales. Teniendo esto en cuenta, en los últimos años se ha formado en la República de Azerbaiyán la base jurídica para grandes obras destinadas a la producción de productos agrícolas en los agro-parques recién creados y planificados, así como para aumentar su potencial de exportación y la adquisición de nuevas variedades productivas para este fin.

Palabras clave: Agricultura, Complejo agroindustrial, Biotecnología, Ingeniería genética, Agro-parques.

INTRODUCTION

Since the 1960s and 1970s of the 20th centuries, thanks to the "Green Revolution", which was characterized by the expansion of the application of mineral fertilizers, pesticides, and modern irrigation systems, and the improvement of selection and breeding work, fundamental intensification of production was achieved in the fields of both crop and animal husbandry in the advanced countries of the world (Rigby & Cáceres, 2001). In modern times, agriculture is in the transition phase from the "Green Revolution" to the "Biotechnology Revolution". Biotechnology is a field of science that studies the possibilities of using living organisms or their metabolic products to solve certain technological problems (Gloy & Dressler, 2010; Timofeeva & Nikitin, 2015). Currently, soil and water resources are becoming more limited every year due to various natural and anthropogenic. In this regard, although the increase in the volume of food production with the help of intensive cultivation methods in agricultural fields is noticeable, significant negative effects have also occurred in the natural environment and ecosystems (Aralbaeva et al., 2020; Ehmke et al., 2010).

In modern times, those factors have enabled the wide application of new technologies that create conditions for the production of sustainable crop and livestock products (van Mierlo et al., 2010). That is why biotechnology acts as a means of ensuring global food security and minimizing negative effects on the environment in modern times (Elzen et al., 2005; Kemp et al., 1998). Today, thanks to biotechnology, plant species resistant to heat, drought, cold, pests, and toxic herbicides, as well as animal breeds resistant to diseases and climate change, are created. Such plant and animal species help to improve production efficiency and significantly reduce the need for pesticides and mineral fertilizers by restoring degraded soils (Nikulnikov & Cretinin, 2007; van der Veen, 2010). Based on this, in recent years, the legal basis for major works in the direction of the production of agricultural products, increasing its export potential, and obtaining new productive varieties in the Republic of Azerbaijan has been formed (Ali & Hajiyeva, 2016).

For this purpose, by the Decree of the President of the Republic of Azerbaijan dated March 16th, 2016, "The main directions of the strategic road map for the main sectors of the national economy" were approved. Accordingly, the "Strategic Roadmap for the production and processing of agricultural products in the Republic of Azerbaijan" was prepared for the production and processing of agricultural products. In that document, a strategic vision for the development of the country's agricultural sector until 2020, a long-term vision for the period up to 2025, and a target vision for the period after 2025 were reflected. The following are reflected in the Strategic Road Map: ensuring food security in the country, increasing the production potential in agricultural areas, forming the production and consumption market in agriculture, creating a financial base, obtaining new plant and animal breeds with the capabilities of biotechnology, creating human resources in agriculture, creation of scientific-technological support in scientific-research institutes and laboratories, improvement of the business environment in the agrarian field, and improvement of living conditions in rural areas (Ismayilov et al., 2012).

That is why the application of modern technologies used in the cultivation of agricultural land in the country, including new irrigation methods (drip, rain, humidification) and efficient planting methods, is being expanded (Hajiyeva, 2023). The application of those methods will not only increase efficiency in the production of agricultural products but will also create conditions for the sustainable use of natural resource potential. Considering the above, the goal of this paper is to briefly discuss the current situation and the main challenges in the development of biotechnology in agriculture in Azerbaijan. To accomplish this, mathematical statistical methods and Geographical Information Systems were used during the research. By using statistical indicators, multi-year indicators were compared, and analyses related to future development were conducted. The geographic coordinates of the existing and planned agro parks within the Republic of Azerbaijan were determined by field research. These were mapped in the ArcGIS program with the help of Geographical Information Systems.

DEVELOPMENT

Agriculture is one of the main economic sectors in Azerbaijan. Agriculture provides the country's population with the most important necessary goods - food. Crop and livestock products produced in the country's agriculture should be competitive, and a wide raw material potential should be created to further develop the agro-industrial complex. The social situation of almost half of the population of Azerbaijan is closely related to rural areas.

The most important task of any biotechnological process in agriculture is the development and optimization of scientifically based technologies and equipment for it, which are widely used in agricultural parks. The effectiveness of biotechnology in the agricultural fields of Azerbaijan directly depends on the country's ecological-geographical conditions, economic situation, as well as renewable biological resources. Increasing biological productivity in agriculture is determined by the characteristics of using soil fertility, methods of combating pests and pathogens of cultivated plants and animals, and methods of preparing food products and improving their nutritional properties. The role of biotechnology in the development and efficiency of traditional agricultural technologies in the country is constantly increasing. Currently, there are special perspectives in this field.

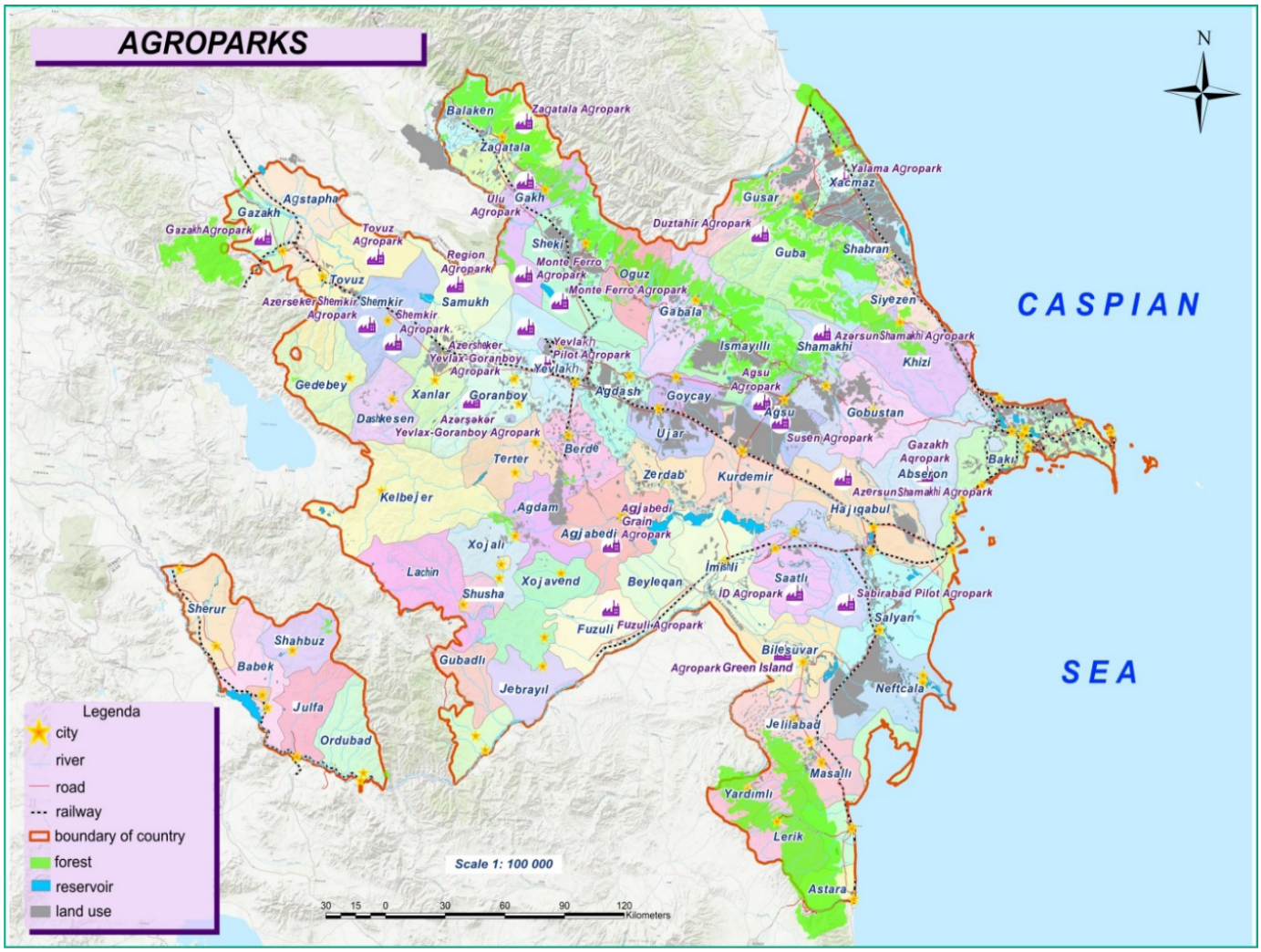
In this sense, the creation and propagation of new varieties of cultivated plants is carried out using the latest methods of biotechnology - cell and genetic engineering. The application of biotechnology is aimed at increasing productivity and nutritional value in crop and animal husbandry, increasing the resistance of cultural biological

species to unfavorable ecological and geographical conditions, pathogens, and pests. But at the same time, the problem of maintaining diversity among cultivated species and protecting genetic resources in general remains relevant.

Almost at the same time as the development of animal husbandry and horticulture in Azerbaijan, the problem of protecting cultivated plants and domestic animals from pests and diseases also arose. On January 22nd, 2021, to sustainably provide the population with agricultural products and increase the export potential of those products, the President of Azerbaijan signed the Decree "On measures to improve the management of industrial parks, industrial districts, and agroparks". It states that in agricultural parks, which are not prohibited by the Law of the Republic of Azerbaijan "On Entrepreneurial Activity", through the application of innovative technologies and methods, they carry out entrepreneurial activities related to the production, processing, packaging, and provision of services, storage, sorting and sale of competitive agricultural products.

For this purpose, 51 agricultural parks with a total project cost of 2.3 billion manats are being created in 32 administrative regions of the country on an area of 239,312 hectares (Figure 1). 34 of those agroparks will specialize in agriculture, 14 in plant breeding and animal husbandry, one in animal husbandry, and two in the processing industry (Table 1). Of these projected 51 agricultural parks, 44 have already started to operate. 184 million manats in concessional loans have been allocated to 25 agricultural parks. In total, up to 4,500 permanent and more than 6,300 seasonal workers work in agroparks (Figure 2).

Fig 1. Existing and planned agricultural parks in Azerbaijan.



Source: own elaboration.

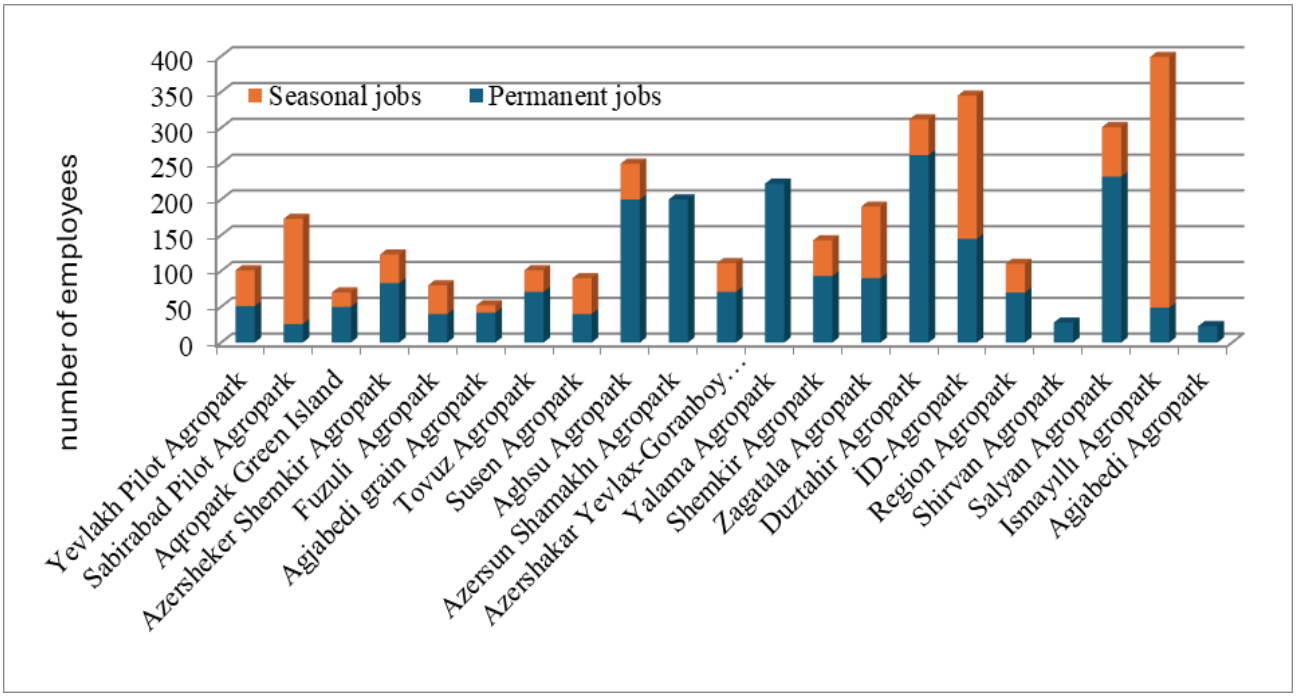
Table 1. General information about the most important agroparks in Azerbaijan.

№	Name of the agropark	Activity address	Areas of activity	Total area	The main products it produces	Jobs	
						Permanently	Seasonal
1	Yevlakh Pilot	Yevlakh district	Horticulture, animal husbandry, processing and more.	2806,5	Wheat, barley, and different kinds of fruits and vegetables	51	50
2	Sabirabad Pilot	Sabirabad district	Horticulture, agriculture, seed production	7544	Cotton, wheat	26	147
3	Green Island	Bilasuvar district	Farming	4666,7	Wheat, barley, corn, cotton	50	20
4	Gazakh	Gazakh and Absheron districts	Farming	808,2	Wheat, barley, potatoes	150	500
5	Azershekar Shamkir	Shamkir district	Farming	8000,0	Wheat, barley, sugar beet, grain corn, soybean	83	40
6	Fuzuli	Fuzuli district	Farming	2700,0	Wheat, barley, cereal corn, almonds	40	40
7	Agjabedi grain	Aghjabedi district	Farming	2285,2	Wheat, barley, corn, cotton	42	10
8	Tovuz	Tovuz district	Livestock and farming	550,0	Wheat, barley, corn, alfalfa, meat	71	30
9	Monte Ferro	Gakh və Shaki districts	Horticulture	2894,0	Hazel	200	300
10	Susen	Aghsu district	Farming	1974,3	Wheat, barley, corn, sunflower	40	50
11	Aghsu	Aghsu district	Livestock and farming	1835,9	Wheat, barley, grain corn, silage corn, alfalfa, soybeans, various types of feed, meat, milk	200	50
12	Azersun Shamakhı	Hajigabul and Shamakhi districts	Livestock and farming	4177,7	Wheat, barley, grain corn, silage corn, sugar beet, soybeans, alfalfa, meat, milk and various types of vegetables	200	
13	Azershakar Yevlax-Goranboy	Yevlakh and Goranboy districts	Farming	2000,0	Wheat, barley, sugar beet	71	40
14	Ulu	Gakh district	Farming and Horticulture	2044,0	Wheat, barley, corn, various fruits and vegetables	112	741
15	Yalama	Khachmaz district	Livestock and farming	1571,9	Wheat, barley, grain corn, silage corn, alfalfa, meat, milk	222	
16	Shamkir	Shamkir district	Horticulture, warehousing, sorting, packaging and logistics	465,0	Different types of fruits	93	50
17	Zagatala	Zagatala, Gakh, Sheki, Oguz districts	Horticulture	1156,5	Different types of fruits	90	100

18	Duztahir	Guba, Gusar, and Khachmaz districts	Horticulture	982,5	Different types of fruits	262	50
19	İD-	Saatli district	Farming and Horticulture	5000,0	Wheat, barley, silage corn, cotton, alfalfa, pomegranate, almonds	145	200
20	Region	Goranboy and Samukh districts	Farming	4695,0	Wheat, barley, corn, and various fruits	70	40
21	Shirvan	Shamakhi district	Livestock	97,9	Construction and installation works are underway	28	
22	Salyan	Salyan district	Livestock and farming	3000,2	Cotton, alfalfa, corn, various fruits, meat	232	69
23	Ismayilli	Ismayilli district	Farming	212,6	Wheat, barley, potatoes	49	350
24	Agjabedi	Agjabadi district	Farming	4800,0	Wheat, barley, grain corn	23	

Source: own elaboration.

Fig 2. Number of permanent and seasonal jobs created in agroparks.

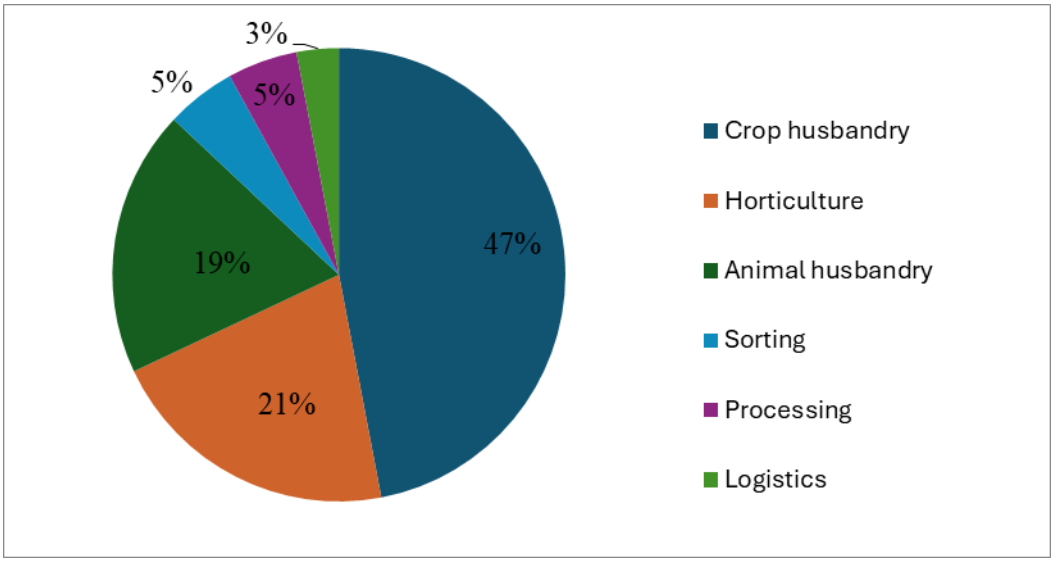


Source: own elaboration.

As can be seen from Figure 3, the directions of activity of agroparks in Azerbaijan are different. Thus, 47% of agricultural parks are used for agriculture, 21% for horticulture, 19% for animal husbandry, and the rest for processing, sorting, logistics, and others. In 2021, 138,000 tons of wheat, 68,000 tons of barley, 94,000 tons of grain corn, 117,000 tons of sugar beet, 71,000 tons of corn for silage, 19,000 tons of cotton, 23,000 tons of soybeans, 27,000 tons of alfalfa, 33 thousand tons of milk and 2.3 thousand tons of meat were produced in agricultural parks. During 2018-2021, intensive orchards with a total area of more than 7,600 hectares were planted in agricultural parks, from which 17,000 tons of

apples, 921 tons of olives, 960 tons of almonds, 934.7 tons of pomegranates, 1,356 tons of grapes were produced in 2021. 715 tons of peaches, 368 tons of pears, and other fruits were collected. Besides, during 2021 a total of more than 23,255 tons of fruit was obtained from orchards.

Fig 3. Activities of agroparks in Azerbaijan, in %.



Source: own elaboration.

The purpose of creating agroparks in Azerbaijan is to create fertile conditions for the production, processing, and packaging of competitive agricultural products based on innovative technologies and methods, the development of agro-industrial complexes, the provision of services, and the support of entrepreneurship in this field. At the same time, ensuring the sustainable development of the country's economy, including the non-oil sector, increasing the availability of local and foreign investments in the field of agro-industrial production, and ensuring the employment of the able-bodied population in the field of agro-industrial production are among the main goals of the creation of agro-industrial complexes.

Nevertheless, the projects to be implemented by the agroparks operating in the country must meet the requirements of the laws of the Republic of Azerbaijan "On environmental protection" and "On environmental impact assessment", as well as the environmental impact assessment and state environmental expertise of those projects must be carried out. The organization, management, and development of the activities of agroparks are carried out under the laws of the Republic of Azerbaijan and other normative legal acts, as well as the regulations and development concept of agroparks. In the case of state-created agroparks, this is done by the managing organization, and in the case of private agroparks, by the entrepreneurial entity that sends a proposal for the registration of those agroparks.

At present, the work on the first phase of some agricultural parks in the country has been completed and they have been put into use. These are "Yalama Agropark" (a feed plant with a capacity of 5 tons per hour and a grain warehouse with a capacity of 4.5 thousand tons, a large farm on an area of 385 hectares) in Khachmaz, "Shamkir Agropark" (a logistics center with a capacity of 21.2 thousand tons, a truck park, a parking lot and a laboratory) in Shamkir and "Guneshli Agropark" (a large grain farm on an area of 1200 hectares, a livestock complex of 500 heads) in Jalilabad.

In addition, in Azerbaijan, construction and installation works are being carried out on the creation of 16 agricultural parks on an area of 81 thousand hectares, and preparatory works on the creation of 23 agricultural parks on an area of 98.4 thousand hectares are being continued. Up to 42 thousand hectares of agroparks and large farms have modern irrigation systems. In general, it is planned to build modern irrigation systems on more than 136,000 hectares of agro-parks. A preferential loan of 98.6 million manats was granted for the creation of 13 agricultural parks with a total value of 350.6 million manats, as well as investment promotion documents for 13 projects worth 390 million manats for 10 agricultural parks.

The creation of agroparks will enable the maximum reduction of the import of food products and the expansion of export possibilities of agricultural products, in addition to meeting the demand for raw materials of horticulture, poultry, and animal husbandry through local production. In addition, a closed chain of production, processing, logistics, and sales has been formed in agroparks, and opportunities have arisen to supply the domestic market with local products, strengthen national brands, as well as increase export potential. But as we have highlighted, the ecological balance is maintained in the production areas of agroparks, their protection is ensured by the efficient use of water and soil resources.

CONCLUSIONS

Considering the limitation of land and water resources in Azerbaijan, intensive production methods have provided a significant increase in food supply, but there have been serious negative effects on the environment and ecosystem. This factor has made it necessary to expand the application of new technologies that enable sustainable agricultural production in modern times. That is why biotechnology acts as a means of radically strengthening global food security and reducing negative effects on the environment in modern times.

The creation of agricultural parks in Azerbaijan can contribute to the modernization of the agricultural sector, increasing efficiency, and diversifying the economy as a whole. It should be noted that the innovative development of agriculture can create favorable conditions for realizing the competitive advantages of the food complex in the country. Of course, in this case, the factor of intensive development plays a decisive role. Considering the indispensable role of intensification in the sustainability of competition in the agro-food industry, the change of producers in the food market, the application of modern technologies, and the sale of increasing commodity products require flexible activity.

On the other hand, cultivation of plant varieties resistant to negative factors in the field of horticulture means the development of biological methods for combating weeds, rodents, phytopathogenic fungi, bacteria, and viruses, microbiological application for land reclamation, acquisition of transgenic plants, processing of waste and agricultural products. A decade of careful research has failed to provide evidence that eating transgenic plants is harmful to humans or animals. The main safety criteria in the development and testing of genetically modified organisms are the absence of toxic and allergic effects of proteins that are not specific to the original plant species.

In the field of animal husbandry, they are widely used for genetic improvement of animal breeds and artificial insemination using monoclonal antibody technology. It can be used by obtaining ecologically clean organic fertilizers based on the recycling of agricultural and animal husbandry wastes by biotechnological means. Based on the principles of sustainable development, the role and importance of agroparks created and planned in Azerbaijan are important for creating a favorable environment to achieve the formation of a competitive agricultural production and processing sector.

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