ISSN: 2707-1146
e-ISSN: 2709-4189

DOI: https://doi.org/10.36719/2707-1146/58/12-15

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The Second Green Revolution: The Role of Biotechnologies in Global Food Security

Abstract

In the context of the rapid growth of the world population, climate change and depletion of natural resources, the issue of global food security has become even more urgent. In these circumstances, the reformation of the agricultural sector and the application of new technological approaches have become a necessity. In this regard, the new era, called the "Second Green Revolution" and based on biotechnology, plays an important role in establishing sustainable and highly productive production models. The development of biotechnology is closely related to the history of technical microbiology and has been observed since ancient times with the use of various microorganisms in food production.

The article also shows that through biotechnological methods it is possible to create varieties of plants and animals resistant to climate change, pests and soil degradation. This allows for increased productivity in local collections, more efficient use of resources and protection from environmental pollution. At the same time, the application of biotechnologies creates legal, social and environmental problems. Accordingly, the creation of legal and institutional mechanisms in accordance with international standards for the management of these technologies, as well as public education is particular importance.

Keywords: *food security, biotechnology, world population, international standard, agriculture*

Introduction

In modern times, the agricultural sector is undergoing a profound transformation on a global scale. If in the middle of the last century, thanks to technological and agronomic changes called the "Green Revolution", productivity was significantly increased and the threat of hunger was partially reduced, this process has now entered a new phase, known as the "Second Green Revolution" or the "Biotechnology Revolution". Although in the previous period, crop production increased with the application of fertilizers, pesticides and irrigation technologies, this approach led to undesirable consequences such as overexploitation of land and water resources, land degradation and the exploitation of ecosystems. The rapid increase in the population of the world and the impact of global climate change have further exacerbated the problem of food shortages.

Research

The rapid growth of the world's population and the impact of global climate change have made the problem of food shortages even more urgent (Secrets Blogspot, 2023).

The world's population is facing many parallel and interacting global problems. Climate change and food shortages are of particular importance here. The 2023 report of the Food and Agriculture Organization of the United Nations (FAO) once again reveals how critical this situation is. Approximately 735 million people in the world are facing food shortages. This means that one in ten people on the planet goes hungry, and this number continues to grow.

Climate change also has a direct impact on private agriculture. Rising temperatures, changing rainfall patterns, and the intensification of extreme weather events such as droughts and floods have led to reduced productivity in many countries. According to the FAO, local crop yields have decreased in 20 countries as a result of climate change. This is particularly acute in sub-Saharan Africa, parts of Asia, and Latin America. On the other hand, the rapid increase in food prices is

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also a global concern. Since 2020, world food prices have increased by more than 35%. One of the main reasons for this increase is climate-related impulses in urban economies and disruptions in supply chains. As a result, part of the population in low-income countries and even in some developed countries is deprived of access to quality and sufficient nutrition (FAO – Food and Agriculture Organization of the United Nations, 2023).

Food insecurity is not only an economic problem, but also a problem with social and political consequences. Food conflicts lead to social tensions, protests, deepening economic instability and, ultimately, forced migration. The mass migration of people from their homelands to cities, and in many cases internationally, shows the social scale of this threat. Therefore, food insecurity is also a serious obstacle to stability and sustainable development. In this situation, a great responsibility falls on states and international organizations. Sustainable agricultural policies, the introduction of climate-adapted production technologies, successful management of water and soil resources, innovations in large areas, support and interregional partnerships are essential conditions for overcoming this problem.

Therefore, there is still a need for more sustainable and environmentally friendly production methods in terms of energy saving. This need emphasizes the need for the application of new technologies, especially biotechnology. Today, biotechnology is considered a strategic tool not only to increase productivity in urban areas, but also to reduce negative environmental impacts and use resources efficiently. Biotechnological approaches allow the creation of plant and animal breeds that are more environmentally sustainable, more adaptable to harsh natural conditions, and more resistant to diseases, thus producing a wide range of products. Thanks to these technologies, new plant varieties are created that are resistant to drought, high and low temperature changes, soil degradation, pests and chemical herbicides.

At the same time, animal species with high adaptability to disasters and climate variability are being bred through genetic engineering methods. These innovations are used to ensure the continuity of production, increase soil fertility and increase the productivity of agricultural areas, especially in lands considered unfavorable and marginal in terms of human resources, and play an indispensable role in improving quality. However, along with all these advantages, there are also potential impacts of the application of biotechnology on the environment, human health and food security, as well as financial and social problems (FAO, 2021). Therefore, the establishment of appropriate legal and institutional frameworks for the production, cultivation and use of biotechnology products has become an important issue. The establishment of effective national control and regulatory systems within each country based on internationally accepted standards and requirements remains one of the main global governance challenges. Decision-making on all scientific principles, including public awareness, plays an important role in the correct and risk-free application of biotechnology.

Taking into account the above and other points, it can be said that biotechnology is a science that studies methods of obtaining substances and products useful for humans under controlled conditions using microorganisms, animal and plant cells, or biological structures isolated from cells. It uses living organisms and biological processes in the practical interests of humans.

The term “biotechnology” was first used in 1917 by the Hungarian engineer Karl Ereki. He used this term to describe the process of feeding pigs using sugar beet feed. According to Ereki, biotechnology is “all work carried out to produce one or another product from raw materials with the help of living organisms”. However, there is still no single and clear position among scientists regarding the concept of “biotechnology”. This is explained by the fact that modern “biotechnology” is not a separate science, but a whole field of knowledge that encompasses biological, exact, etc. fields of science and unites numerous sciences (FAO, 2023).

In 1675, Antoni Van Leeuwenhoek first described microorganisms, marking the beginning of the descriptive era of microbiology. However, there is evidence of beer brewing long before this discovery, dating back to 6000 BC. In ancient times, people used microorganisms to make vinegar, yogurt, cheese, etc. from dairy products, to soften fibrous plants, and to make bread and wine (Alizadeh, 2019).

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Check out the benefits of apples in biotechnology

- It allows the timely detection of epidemics and roadborne diseases that may spread in the future.
- With the application of modern technologies, the preparation of bonds can be implemented more quickly and efficiently.
- It is possible to combat hereditary diseases and reduce their spread.
- Productivity is increased in the field of animal husbandry, and the breeding of breeds that are resistant to diseases is ensured.
- It prevents the preparation of new generation treatment preparations for severe diseases that are difficult to treat.

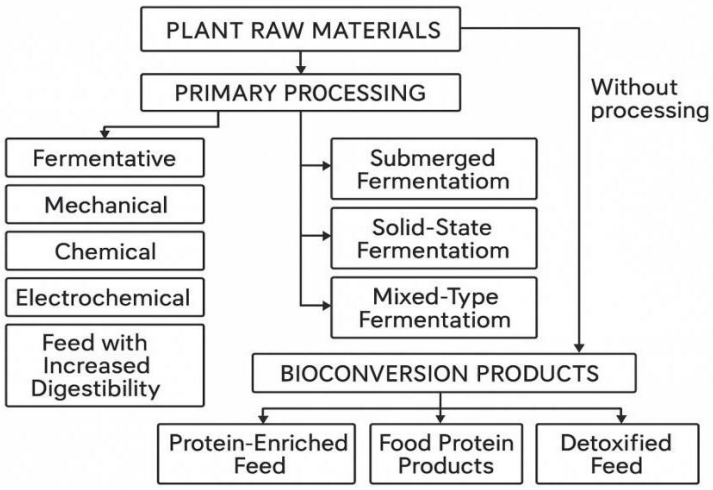
Biotechnology negative effect their potential there are:

- There is a possibility that dangerous biological agents based on living organisms could be used as weapons.
- The production of genetically modified fruit plants may have undesirable consequences for the health and environment.
- As a result of biotechnology activities, there is a risk of discharging harmful and toxic substances into the environment.
- Of course, ecological disasters that have been formed over long years can be created as a result of biotechnological interventions.
- Chemical substances and processes used in biotechnology can cause pollution of air, water and soil.

Unsupervised genetic modifications and modified organisms introduced from the laboratory environment can compromise the stability of ecosystems and jeopardize biological diversity (Secrets Blogspot, 2023).

At present, the processing and understanding of biotechnology is practically essential in the activities of all countries. One of the central tasks in the economic policy of developed countries is to achieve success in biotechnology. Now USA and Japan are leaders in biotechnology and have extensive experience in this field in the field of personal savings, pharmaceuticals, food and chemical industry. Other European countries (AFR, France, Great Britain), as well as Russia has strengthened its position in the production of ferment preparations, amine pickles, zulal, natural preparations. One of the important directions is the extraction of waste and feed products from plant materials through bioconversion (Figure 1.4) (Strategy Roadmap on the production and production of self-made products in the Republic of Azerbaijan, n.d.).

Figure 1.4. Bioconversion scheme of plant raw materials Wikipedia contributors. (n.d.)



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Conclusion

As a result, biotechnologies are likely to play a strategic role in ensuring food safety and provide important opportunities for continuous development in the protection of the ecological environment, but also for future generations. It emerges as one of the main tools in formalizing durable models of self-savings.

The struggle with climate change is not just a matter of ecology, but also a matter of strategy in terms of food safety. For the sake of continuous and successful development, it is necessary to approach these two problems in a complex and integral way.

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Received: 20.04.2025
Accepted: 05.07.2025