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ADVANCING SUSTAINABLE AGRICULTURE: THE INTERSECTION OF TRANSGENIC AND ORGANIC AGRICULTURE

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Abstract – The search for solutions to the challenges in world agriculture, especially the growth in global food supply and inadequacies in meeting demands, leads to the emergence of development treatments such as biotechnological and organic agriculture. This article considers variables such as the limitations of conventional agriculture, the demonstrated impacts, and global food demand, how the combination of transgenic agriculture and organic agriculture can provide a balance to sustainable agriculture conservation. The developing neo-liberal economy and production distribution have led to rapid changes in agreement production series and the introduction of these new technologies has been triggered. However, factors such as traditional agriculture facing expansion limits, severe problems and climate change have limited the increase in productivity and caused a significant portion of the world to struggle with hunger. Changes in the consciousness level of consumers have resulted in the distribution of more and more diverse foods. It plays an important role in biological, biotechnological. Biotechnology offers the potential to provide resistance, increase productivity and food production by changing the characteristics of plants, animals and microorganisms through genetic engineering. In the study, the basic policies of organic agriculture and the scope of biotechnology are discussed in detail. While organic agriculture offers a solution that is compatible with natural cycles, supports soil growth and minimizes the effects of growth, biotechnological genetic engineering and division through organisms make various contributions to production. The combination of transgenic agriculture with organic farming principles will create the potential to create an environmentally friendly agricultural practice. However, ethical, social and economic problems brought by this union are also observed. Social acceptance and ethical considerations are critical users in the communities of biotechnology and organic agriculture. While the study emphasizes that the combination of transgenic and organic agriculture can be the key to sustainable agriculture, it emphasizes the concerns of society and the responsibilities brought by this new approach.

Keywords – Transgenic, Organic, Agriculture

1. Introduction

Despite all the technological developments in world agriculture, the inclusion of non-agricultural areas in agricultural production regions and the spread of mechanized agriculture, the global food supply is shrinking and is unable to meet the demand for human food. While the demand for grain is increasing rapidly worldwide, the increase in grain production has slowed significantly due to factors such as the opening up of agricultural land to non-agricultural uses such as settlement, tourism and industrialization, irregularities due to global climate change, unsustainable use of water resources and declining irrigation water. [1]

In the last quarter of a century, consumer habits have evolved under the influence of the neoliberal economy towards an excessive and unhealthy diet that ignores the culture of nutrition. This situation

has led to the rapid introduction of new techniques in agricultural production processes to meet demand. In the traditional agricultural system, the increase in agricultural production was achieved through the expansion of agricultural land, effective cultivation techniques and improved varieties. In recent years, however, the desired increase in production has not been achieved because productive agricultural land is being used for non-agricultural activities, the productive land that can be used is reaching marginal limits, genetic diversity is decreasing and environmental problems are arising. This situation contrasts with the fact that around a third of the world's population is struggling with hunger [2].

If we look at the consumer perspective, we can see that the demand for food is becoming increasingly diverse depending on the development of income levels. While daily calorie consumption averaged 2,600 calories in the 1990s, this figure is expected to exceed 3,000 calories in the 2030s. [3]. In addition, as part of the change in consumer awareness, the tendency to consume plant-based products is increasing day by day, especially the tendency to meet protein and fat requirements from plant-based products is clearly visible. Biotechnological studies today offer important opportunities to make human life easier, eliminate health problems and prolong human life.

Biotechnology is a very broad concept and various definitions can be found in different sources. The International Institute of Biotechnology defines biotechnology as "the use of organisms by humans" [4]. All of the methods used to obtain a new organism (plant, animal or microorganism) by using or parts of it or to make the desired changes in the genetic structure of an existing organism are called "Biotechnology". Biotechnology is an art performed using scientific tools on living things and their products. Biotechnology offers solutions to some problems of economic importance that cannot be solved by classical breeding methods in agriculture. The transfer of genes that provide resistance to diseases and pests leads to a decrease in the amount of pesticides used and at the same time an increase in yield. This offers more sustainable and economical solutions in agricultural production. One of the contributions of biotechnology to agriculture is extending shelf life and increasing aroma. This provides convenience in the food industry by optimizing the storage processes of products. It also allows products to stay fresher longer and be more attractive during the marketing phase. These methods can play an important role in increasing efficiency in agricultural production and supporting sustainable agriculture by providing alternative solutions to the challenges encountered in traditional agricultural practice. However, it can be argued that it carries some risks apart from these benefits [5].

The intensive use of chemicals and pesticides in traditional agriculture has had a negative impact on the ecology. Pollinator insects are very important for organic and sustainable agriculture. Except for cereals, most food-producing plants depend almost entirely on insects for pollination Decreased natural resources, excessive use of pesticides, sudden changes in meteorological factors have begun to threaten bees[10]. Despite this situation, IFOAM has introduced the system of organic farming, which maintains and guarantees the health of the soil, the ecosystem, and people in the long term. This system is based on organic processing, biodiversity and cycles adapted to local conditions, rather than the use of inputs that have a negative impact. This agricultural approach combines traditional methods, new inventions, and science to protect the environment, promote fair relationships and improve the quality of life for all involved. The foundation of organic farming is an understanding of how to promote sustainable agricultural practices while respecting the natural balance. This approach minimizes the use of chemical inputs and applies ecosystem-friendly farming methods to protect the quality of soil, water and air. In addition, organic farming aims to adapt to regional conditions in order to support the local economy, strengthen local farmers and increase food security. In this way, both environmental sustainability and social benefits are achieved. Organic agriculture aims to leave a healthy environment for future generations by preserving natural resources and

balancing ecosystems [6]. Products produced in accordance with these specific standards can obtain registration as an organic product after inspection and certification procedures by authorized institutions [7].

Although transgenic agriculture and organic farming may appear to be opposites at first glance, the interaction of these two systems can achieve a more sustainable balance in terms of the environment, natural resources and biodiversity. The newly developed approaches aim to increase production while minimizing the environmental impact and maintaining healthy and high-quality products. In particular, the focus of transgenic agriculture on crops such as corn, cotton, soybeans and rapeseed has played an important role in meeting the world's food needs. These crops can be grown over large areas and grow efficiently, which is a significant advantage for food production. However, with these benefits have come increased concerns about food safety. Organic farming, on the other hand, relies on natural methods. Organic farming takes a more environmentally friendly approach by limiting the use of chemical fertilizers and pesticides. In recent years, people have tended to opt for organic products due to food safety concerns. By combining these two systems, the environmentally friendly principles of organic farming can be combined with the use of transgenic traits to increase disease resistance or productivity, for example. This approach supports both food production through greater efficiency and the protection of natural resources. However, the ethical, social and economic problems that such a combination entails should also be taken into account.

2. Organic Agriculture and Biotechnology Collaboration

The comparison between the concepts of organic farming and biotechnology will contribute to a better understanding of these two disciplines. The basic principles of organic farming can be evaluated within the framework of nature-friendly production, closed farming and product rotation [8]. These principles are as follows:

1. Sustainable production chain: High-quality and sufficient production will be achieved by introducing a sustainable system throughout the entire production chain. This includes the introduction of ecologically and economically sustainable agricultural practices.

2. Adaptation to natural cycles and living systems: The goal is to work in harmony with natural cycles and living systems within the production system. This principle includes understanding, preserving and utilizing historical knowledge and traditional agricultural systems.

3. Maintaining soil fertility and biodiversity: Considering soil fertility as the basis of production capacity, the long-term maintenance of soil fertility and biological activity through cultural, biological and mechanical methods such as crop rotation, appropriate tillage, green manure, animal manure and compost instead of intensive use of inputs is sought and shall be increased.

4. Minimizing the environmental impact: The aim is to minimize the impact of agricultural activities on the environment and on human and animal health. This principle requires that no chemical-synthetic fertilizers, pesticides, hormones and additives may be used.

5. Living conditions that meet the natural needs of the animals: In animal production, living conditions should be created under which the animals can satisfy their natural needs.

6. Protection of water resources: The aim is to protect and properly use water resources and water-related life systems.

7. Preservation of organic product characteristics: The aim is to ensure that the products produced in organic farming retain their organic characteristics at all stages, such as processing and packaging.

8. Safe and healthy working environment: The aim is to provide a safe and healthy working environment for all those involved in the organic production and processing system, in which they can satisfy their basic needs.

9. Socially and ecologically balanced production chain: Promotes the creation of a socially just and ecologically balanced production, processing and distribution chain. It also aims to promote local and regional production and distribution.

10. Organic product guarantee: The aim is to provide consumers with organic product safety by verifying production in accordance with national and/or international organic farming rules by independent inspection companies.

1. . Definition of Biotechnology:

- It is a field of technology that encompasses scientific areas such as cell biology, tissue culture, molecular biology, microbiology, genetics, physiology and biochemistry.
- It aims to develop plants, animals and microorganisms with the help of recombinant DNA technology, using disciplines such as mechanical engineering and computer technology.
2. Area and departments of biotechnology:
-It consists of different sub-branches such as microbial, aquatic, plant, animal and medical biotechnology.
3. Potential and areas of application:
-It makes an important contribution to agricultural production.
-It can be used in many areas, e.g. in the production of gene products, the synthesis of recombinant drugs and vaccines.
-Genetic products are used to treat and prevent diseases such as cancer and AIDS.
4. Examples of applications:
- Repair of damaged brain cells and spinal cord.
- Development of bacteria that metabolize organic waste.
- Production of plant varieties that are resistant to herbicides and diseases and have better fruit quality.
5. Various applications of biotechnology:
- Application of modern technology to the natural sciences.
- The various applications of biotechnology include industrial use and bioremediation.
Biotechnology encompasses the natural sciences as well as the disciplines of engineering and computer technology. Microbial, aquatic, plant, animal and medical biotechnology form different areas of biotechnology [9].
There are a number of similarities and differences between the organic farming system and biotechnology.

A. Common Aspects:

1. Environmental Awareness:
- - Organic farming and biotechnology focus on minimizing environmental impact. Organic farming takes an environmentally friendly approach by limiting the use of synthetic chemicals. Similarly, biotechnology considers the impact on the environment in applications such as the treatment and prevention of various diseases.
2. Sustainability:
- Both systems strive for a sustainable production chain and the protection of natural resources. While organic farming aims at the sustainability of soil fertility and biodiversity, biotechnology supports the principle of sustainability by contributing to agricultural production.
3. Product quality and safety:
- Both organic farming and biotechnology attach great importance to product quality and safety. Organic farming emphasizes products that are produced using natural methods and free of chemical residues. Biotechnology, on the other hand, improves the properties of products through genetic modification and gives them resistance to certain diseases.

B. Differences

1. Production methods:
- Organic farming rejects artificial interventions such as chemical fertilizers, synthetic medicines and genetic modification. It uses completely natural and biological methods. Biotechnology, on the other hand, modifies the genetic structure of organisms and improves their characteristics through genetic engineering.
2. Focus areas:
- While organic farming focuses primarily on sustainable production in harmony with nature, biotechnology aims to change and improve the characteristics of plants, animals and microorganisms through genetic engineering.
3. Use of chemicals:
- While organic farming does not use chemical fertilizers, drugs and hormones, biotechnology takes a different approach in this area by adding traits that are not present in nature through genetic engineering.
Although both systems offer unique advantages in food production, they are still important players in environmental and health issues with their different approaches.

3. Regulation and Social Acceptance

Some concerns have been raised in society about transgenic products. We can assess these risks under the following headings;
1. Health risks:
- Potential allergenicity: GMOs can cause allergic reactions due to the genetic modifications they contain. This can be particularly the case if a new allergen is created or an existing allergen is enhanced.

- Potential toxicity and carcinogenicity: The genetic material contained in GMOs can potentially have toxic or carcinogenic effects on human health.
- Formation of antibiotic-resistant microorganisms: The transfer of antibiotic resistance genes in the genetic processes used in GMO production may increase the risks associated with the use of antibiotics.
- Deterioration of nutritional value: GMOs can cause unexpected changes in nutrient content, which can lead to problems in terms of nutritional value.

2. Environmental hazards:
- Soil and water pollution: the release of GMOs into nature can increase the potential for soil and water pollution.
- Alteration of fauna, alteration of microorganisms, alteration of flora: The impact of GMOs on the environment can lead to changes in natural ecosystems, which in turn can have an impact on biodiversity.
- Variability and unexpected consequences: The effects of genetic modification on natural populations can have unpredictable consequences.

3. Socio-economic risks:
- Costliness: the cost of GMO seeds may be more expensive for farmers, leading to an increase in operating costs.
- Uniform variety diversity and use of pharmaceuticals: GMOs can lead to greater plant diversity and the use of chemical medicines, which may allow plants to develop resistance to pests.
- Annual renewal of seeds, variety mix: GMOs may require annual renewal of seeds, which means additional costs for farmers. This can also lead to a loss of traditional seed diversity.

4. Religious and ethical issues:
- Muslims and Jews: the presence of pig genes or other genetic material that does not conform to religious restrictions in GMO crops may be religiously problematic for these groups.
- Vegetarians: The consumption of plants containing animal genes may pose ethical problems for vegetarians. In this case, it is important to label GMO products and to be transparent about the genetic information they contain.

Effective regulation and transparent communication about these risks can help to ensure that biotechnology develops in a sustainable and socially acceptable way.

Conclusion

Those who oppose the production of plants and animals improved by biotechnological methods are usually supporters of organic farming, and they usually justify their objections by arguing that this is not compatible with the nature of organic farming. However, the large investments in biotechnology made by many countries that support organic farming show that there is no sound evidence that these objections are scientifically justified. These investments show that technology has an important role to play in agriculture and can be integrated into sustainable farming practices. If the steps taken by these countries are ignored, there is a risk that they will not be able to meet future challenges in agriculture. On the other hand, there are still no scientific studies in our country that show that biotechnology is not suitable for organic farming. Therefore, the use of biotechnology in organic farming should not be prevented before such studies have been carried out.

It is clear that biotechnological developments will continue to offer important opportunities in plant and animal production in the future. However, the impact of these developments on human and animal health and the environment must be carefully assessed. In addition, the increasing global demand for organic products reflects the tendency of consumers to prefer healthy products. The combined use of transgenic and organic farming systems therefore requires a comprehensive analysis from an economic, social and health perspective. The unity of these systems requires defining the basic principles of how sustainable agricultural practice can be achieved in the most effective and profitable way.

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