THE DEVELOPMENT OF MICROBIOLOGICAL TECHNOLOGIES IN UZBEKISTAN AND THE CREATION OF THE NEW-GENERATION PRODUCT EM GUMI ORGANIC: SCIENTIFIC FOUNDATIONS, PRACTICAL RESULTS, AND FUTURE PROSPECTS

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Is the Soil Alive? Why Was This Article Written?

Throughout human history, soil has been the primary source of food production and the foundation of agricultural development. However, during recent decades, the excessive use of mineral fertilizers and chemical inputs in pursuit of higher crop yields has significantly disrupted the natural biological balance of soils. Today, scientists around the world are reaching a common conclusion: The future of agriculture depends not on feeding the soil with increasing amounts of chemicals, but on restoring and maintaining its biological life. For this reason, microbiological technologies are attracting growing scientific and practical interest in countries such as the United States, Japan, Germany, Türkiye, South Korea, and many others. Uzbekistan should not remain outside this global transformation. The country's soils must not only sustain high agricultural productivity today but also preserve their biological fertility for future generations. In response to this challenge, many years of scientific research, practical experimentation, and adaptation to local agro-climatic conditions have led to the development of the EM GUMI ORGANIC microbiological technology. The purpose of this article is to present the historical evolution of this technology, explain its scientific foundations, summarize its practical implementation across the Republic of Uzbekistan, and discuss its future development prospects.

Author's Note

This article has been prepared on the basis of many years of scientific research, field observations, collaborative work with governmental and scientific institutions, and practical results obtained from agricultural enterprises and farming operations. Its purpose is not to promote a particular commercial product. Rather, it aims to highlight the importance of preserving soil biology, to emphasize the growing role of microbiological technologies in sustainable agriculture, and to provide an overview of the scientific and practical achievements accomplished in this field within the Republic of Uzbekistan.

Abstract

Over the past several decades, the intensive use of mineral fertilizers in agriculture has resulted in a decline in soil biological activity, depletion of humus reserves, and disruption of ecological balance. Consequently, microbiological technologies aimed at restoring the natural soil microflora have become one of the priority research areas in modern agricultural science. This article presents the history of the development of Effective Microorganisms (EM) technology in Uzbekistan, its scientific foundations, the stages of its adaptation to local agro-climatic conditions, and the scientific and practical activities carried out by AGRO EM TEHNOLOGIYA LLC. It also describes the development of the new-generation microbiological product EM GUMI ORGANIC, created as a result of these long-term scientific and technological efforts.

Keywords: Effective Microorganisms (EM), soil microbiology, sustainable agriculture, microbiological technology, soil fertility, beneficial microorganisms, EM GUMI ORGANIC, Uzbekistan.

Introduction

Agriculture is a strategic sector that plays a fundamental role in ensuring global food security. However, the prolonged and intensive application of mineral fertilizers to maximize crop productivity has gradually disturbed the biological equilibrium of agricultural soils, reduced populations of beneficial microorganisms, and decreased the efficiency of nutrient utilization by plants. According to the company's research materials, EM technology contributes to the restoration of the natural soil microbiota, facilitates the conversion of insoluble phosphorus and potassium into plant-available forms, and enhances overall soil fertility. Therefore, microbiological technologies are increasingly recognized not only as instruments for improving crop productivity but also as essential components of environmentally sustainable agricultural systems.

The Historical Development of Effective Microorganisms (EM) Technology

The company Baikal-KMU, operating on the basis of Effective Microorganisms (EM) technology, was established in 2006 by Professor Pyotr Ayusheevich Shablin and Dr. Bahodir Takhirovich Bayjanov. The company's primary objective was to develop innovative microbiological products based on EM technology and introduce them into practical agricultural production. The technology is founded on the synergistic interaction of more than 80 species of beneficial microorganisms, including:

- lactic acid bacteria;
- photosynthetic bacteria;
- nitrogen-fixing microorganisms;

- actinomycetes;
- yeasts;
- humic acids;
- amino acids;
- and other biologically active compounds.

However, the environmental conditions of Uzbekistan differed considerably from those of the region where the original technology had been developed. Consequently, successful implementation required not a direct transfer of the technology, but its comprehensive scientific adaptation to the country's unique soil and climatic conditions.

Localization of EM Technology in Uzbekistan: From a Scientific Approach to National Biotechnology

Effective Microorganisms (EM) technology, originally developed in Russia, was designed as an innovative scientific solution for restoring soil microflora, supporting the natural physiological development of plants, and promoting environmentally sustainable agricultural production. However, the effectiveness of any microbiological technology is inherently dependent on the environmental conditions in which it is applied. Soil composition, climate, temperature, moisture regime, water quality, organic matter content, and indigenous microbial communities differ significantly from one country to another. From this perspective, a technology that demonstrated high performance under Russian conditions required comprehensive scientific adaptation before it could be effectively implemented in the agroecological environments of Uzbekistan. In the early 2000s, scientific collaboration was established between the Russian researcher Dr. Pyotr Ayusheevich Shablin and the Uzbek scientist Dr. Bahodir Takhirovich Bayjanov. According to the company's archival records, this collaboration ultimately led to the establishment of Baikal-KMU in 2006, providing a strong scientific foundation for the further development of EM technology in Uzbekistan. The activities carried out in Uzbekistan were not limited to importing an existing microbiological product. Instead, the technology underwent a long-term process of scientific adaptation and improvement based on local environmental conditions and extensive experimental research.

During this process, the following key objectives were accomplished:

- investigation of the microbiological characteristics of local soils;
- optimization of fermentation processes under regional conditions;
- development of technological solutions capable of maintaining stable microbial activity in Uzbekistan's climate;

- refinement of application protocols for major agricultural crops;
- implementation of long-term field observations across diverse soil and climatic regions.

The primary objective of this work was not to reproduce an existing technology, but rather to adapt it to Uzbekistan's unique agroecological conditions and to create an innovative microbiological product capable of delivering consistently high performance in local agricultural systems. Years of accumulated scientific knowledge, laboratory investigations, and extensive field trials gradually elevated the technology to a new level of development. As a result, the former Baikal EM-1 formulation was substantially improved through the enrichment of its microbial consortium and the refinement of its production technology, ultimately leading to the creation of the new-generation microbiological product marketed under the name EM GUMI ORGANIC. This transformation should not be regarded merely as a rebranding process. Rather, it represents an evolutionary stage of technological development achieved through many years of scientific research, practical experimentation, and continuous technological improvement. Today, AGRO EM TEHNOLOGIYA LLC, operating on the basis of this scientific platform, continues the next phase of EM technology development by introducing the technology into diverse soil and climatic regions throughout the Republic of Uzbekistan, conducting systematic scientific observations, cooperating with governmental and research institutions, and expanding opportunities for international collaboration and export.

Agro em tehnologiya llc: A National Biotechnology Company Bringing Scientific Innovations into Agricultural Practice

The next stage in the development of microbiological technologies in Uzbekistan was characterized by the successful integration of scientific innovation with large-scale practical implementation. During this period, AGRO EM TEHNOLOGIYA LLC carried out systematic activities aimed at further developing, improving, and evaluating EM technology under diverse agricultural conditions throughout the Republic of Uzbekistan. The Company's strategic mission extends beyond the production of microbiological products. Its primary objectives include restoring soil fertility, promoting the rational use of mineral fertilizers, supporting environmentally sustainable agriculture, and providing farmers with scientifically validated agrotechnological solutions. To achieve these goals, product evaluation was not confined to laboratory testing. Instead, the technology underwent extensive field validation under different soil and climatic conditions, across multiple crop species, and within various farming systems.

Nationwide Practical Implementation

During recent years, EM GUMI ORGANIC has been applied across numerous regions of Uzbekistan. Field evaluations have included cotton, wheat, vegetables, melons, orchards, greenhouse production systems, and ornamental trees. This comprehensive evaluation strategy enabled researchers to compare the product's performance across different regions, crops, and environmental conditions over multiple growing seasons.

Cooperation with Scientific Institutions

To ensure objective evaluation, AGRO EM TEHNOLOGIYA collaborated with governmental agencies and scientific institutions rather than relying solely on internal observations. Among the major collaborative activities were:

- scientific assessments conducted by specialists from Green University regarding the practical effectiveness of EM GUMI ORGANIC;
- implementation of the product within the "My Garden" (Mening Bog'im) project in the Khorezm Region, where positive effects on ornamental trees were officially documented;
- preparation of official evaluation reports confirming product performance under practical farming conditions. These independent assessments demonstrate that the effectiveness of the product has been confirmed not only through the Company's internal observations but also through external scientific evaluations.

Continuous Technological Improvement

Long-term research and field observations have continuously contributed to the refinement of both the product formulation and its application methodology. Building upon the earlier Baikal EM-1 technology, researchers enriched the microbial consortium, optimized production processes for local conditions, and introduced the improved product under the EM GUMI ORGANIC brand. Particular attention was devoted to:

- increasing microbial stability;
- optimizing fermentation processes;
- improving storage stability and product quality;
- developing crop-specific application protocols.

Practical Conclusions

Based on nationwide observations, the Company reached several important practical conclusions. First, the effectiveness of EM GUMI ORGANIC is closely associated with its regular application in accordance with recommended agronomic practices. Second, by stimulating biological processes within the soil ecosystem, the product enhances the efficiency of mineral fertilizer utilization.

Third, field observations conducted under diverse soil and climatic conditions indicate that application programs should be adapted to the specific environmental characteristics of each agricultural region. Furthermore, according to the Company's long-term practical experience, the highest agronomic and economic benefits are achieved when EM GUMI ORGANIC is applied at least four times during the growing season for seasonal crops. This recommendation has been established through many years of field observations conducted in different regions of Uzbekistan.

Scientific and Practical Effectiveness of EM GUMI ORGANIC: Nationwide Field Evaluations and Official Assessments

The true effectiveness of a microbiological product should not be judged solely by laboratory results. Rather, its value must be demonstrated through repeated field validation under diverse soil and climatic conditions within commercial agricultural production. From this perspective, EM GUMI ORGANIC, developed by AGRO EM TEHNOLOGIYA LLC, has been evaluated in cooperation with farmers, horticultural enterprises, greenhouse producers, and governmental organizations across different regions of the Republic of Uzbekistan. These field evaluations provided an opportunity to assess the product's performance under various crop production systems and agro-climatic conditions.

Field Results in the Khorezm Region

EM GUMI ORGANIC was also applied within the framework of the "My Garden" (Mening Bog'im) project in the Khorezm Region. The product was used on a variety of ornamental tree species, including:

- Elm (*Ulmus* spp.);
- Catalpa (*Catalpa* spp.);
- Japanese Pagoda Tree (*Styphnolobium japonicum*, formerly *Sophora japonica*);
- Ash (*Fraxinus* spp.);
- Mulberry (*Morus* spp.);
- Poplar (*Populus* spp.);
- and other ornamental tree species.

Field Evaluations in the Republic of Karakalpakstan

The product was also evaluated under agricultural conditions in the Republic of Karakalpakstan. Field observations indicated that EM GUMI ORGANIC maintained its biological activity and practical effectiveness even under conditions characterized by:

- elevated temperatures;

- saline soils;
- limited water availability.

These findings demonstrate the product's potential applicability across the diverse agroecological zones of Uzbekistan.

The Company's Practical Approach

AGRO EM TEHNOLOGIYA does not limit its activities to supplying microbiological products. Each implementation project includes:

- continuous field monitoring;
- agronomic supervision;
- evaluation of application protocols;
- practical recommendations for farmers;
- comparative analysis of production results.

This integrated approach enables the Company to continuously improve both its products and its agronomic recommendations based on practical field experience.

Scientific and Practical Conclusion

According to the Company's field observations, the effectiveness of EM GUMI ORGANIC has been supported by practical work conducted in different regions of Uzbekistan, observations involving governmental organizations, and official field evaluation reports. Based on these documented activities, the product may be regarded not merely as a theoretical microbiological concept but as a technology that has undergone practical implementation and evaluation under the agricultural conditions of the Republic of Uzbekistan.

From Scientific Development to National Recognition: The Evolution of a National Innovation

The true value of an innovative technology is determined not only by its laboratory performance or experimental trials but also by its recognition at the national level, successful implementation in practice, and acceptance by the wider scientific and agricultural communities. The development of EM technology under the conditions of Uzbekistan has followed precisely such a progressive path.

Presentation of the Innovation to the President of Uzbekistan

On 16 June 2017, during a visit to the Technopark in the Uchtepa District of Tashkent, the innovative microbiological technology was presented to the President of the Republic of Uzbekistan, Shavkat Mirziyoyev. During the presentation, information was provided on the technology's potential contribution to:

- preserving soil fertility;
- improving the efficiency of mineral fertilizer utilization;
- promoting environmentally sustainable agricultural production.

According to the source material, this event represented an important milestone in the history of the technology, marking its transition from a scientific development to an innovation receiving attention within the context of the country's agricultural modernization efforts.

Growing Interest from Governmental Institutions

Following the presentation, increased attention was directed toward microbiological technologies by governmental organizations responsible for agricultural development. During this period, additional evaluations of the technology were carried out with the participation of state institutions, scientific organizations, and farming enterprises. These activities contributed to the further scientific validation and practical refinement of the technology.

Recognition Within the Scientific Community

Research related to EM technology has attracted interest not only within Uzbekistan but also internationally.The source document notes that a doctoral dissertation defended in Türkiye examined the influence of EM technologies on soil fertility and plant development, providing an academic analysis of their potential applications. Within Uzbekistan, practical studies were complemented by scientific assessments prepared by Green University and other research institutions, thereby strengthening the scientific foundation of the technology.

Public Awareness

Information concerning the technology was also communicated to the wider public. Special television programs produced by the National Television and Radio Company of Uzbekistan presented the product's agricultural applications, practical field results, and farmers' experiences. These broadcasts contributed to increasing public awareness among agricultural producers, specialists, and other stakeholders.

From a Scientific Idea to a National Technology

An analysis of the overall development process leads to an important conclusion.

EM technology was not introduced into Uzbekistan simply as a finished imported product. Instead, it underwent continuous scientific adaptation, practical validation, and technological improvement through many years of local research, cooperation with governmental and scientific institutions, and extensive field implementation. As a result of this evolutionary process, the

technology advanced to the level of a nationally developed agricultural biotechnology, ultimately leading to the creation of EM GUMI ORGANIC.

Em gumi organic: From Uzbekistan to International Cooperation

The development of modern microbiological technologies cannot be limited to domestic markets alone. Today, the success of biotechnology is also measured by international scientific cooperation, technology exchange, and export potential.

In recent years, AGRO EM TEHNOLOGIYA LLC has initiated a number of activities aimed at introducing EM GUMI ORGANIC to international markets.

Representatives of the Company have participated in official meetings in the United Arab Emirates, where opportunities for cooperation in the field of agricultural biotechnology were discussed. In addition, negotiations have been initiated regarding the prospective application of the product within the agricultural sectors of Sudan and Egypt. The expansion of cooperation with the countries of Central Asia, together with the development of scientific partnerships with research institutions in Türkiye and other countries, represents one of the Company's strategic priorities. These activities demonstrate the Company's intention to adapt EM GUMI ORGANIC not only to the requirements of the domestic market but also to the expectations of the international agricultural sector.

Future Outlook

The long-term vision of AGRO EM TEHNOLOGIYA LLC extends far beyond the production of a single microbiological product. The Company continues to invest in scientific research aimed at:

- improving the restoration of soil biological activity;
- increasing the efficiency of mineral fertilizer utilization;
- developing environmentally sustainable agricultural technologies.
- In addition, the creation of new-generation microbiological products, compliance with international quality standards, and the expansion of export markets constitute essential components of the Company's long-term development strategy.

Conclusion

Soil is the fundamental resource upon which every agricultural production system depends. Without preserving its biological activity, it is difficult to achieve both sustainable crop productivity and long-term environmental stability. EM GUMI ORGANIC represents the outcome of many years of scientific research, adaptation to local agroecological conditions, and extensive practical evaluations

conducted throughout the Republic of Uzbekistan. According to the source material, the technology has been evaluated with the participation of governmental organizations, scientific institutions, and farming enterprises. The establishment of national standards, legal documentation, and ongoing international cooperation further supports its continued development. Today, microbiological technologies are increasingly recognized as important tools for preserving soil fertility, producing environmentally responsible agricultural products, and promoting the sustainable development of agriculture. Within this context, EM GUMI ORGANIC may be regarded as the result of scientific research and practical experience developed in Uzbekistan in the field of agricultural microbiology.

"Life to the Soil — Prosperity to Humanity.".

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