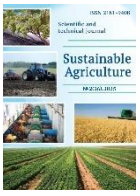
Sustainable Agriculture 3 (27) (2025) 16–18

Contents lists available at https://susagr.uz/index.php/ojs/issue/view/7

Sustainable Agriculture

journal homepage: https://susagr.uz/index.php/ojs



Problems and Innovative Solutions in Agriculture Caused by Global Climate Change

Khujamkulova Khosiyat[a], Mukhsiddinov Abrorxoja[b]

[a] *"Tashkent Institute of Irrigation and Agricultural Mechanization Engineers" National research university, Senior lecturer of the Department of "Management and Tourism", Faculty of "Economy"*

[b] *"Tashkent Institute of Irrigation and Agricultural Mechanization Engineers" National research university, student of the Faculty of "Economy"*

a r t i c l e i n f o

Keywords:
innovation, global climate, agriculture, growing season, water-saving irrigation technologies (drip and sprinkler irrigation), climate-adapted agricultural crops, digital monitoring systems, agrotechnical measures.

a b s t r a c t

This article highlights the relevance of problems such as increased drought, changes in the growing season, and reduced productivity as a result of the impact of global climate change on agriculture, and innovative solutions to these problems are discussed, including water-saving irrigation technologies (drip and rain irrigation), climate-adapted agricultural crops, digital monitoring systems, and improvements in agrotechnical measures.

1. INTRODUCTION

Nowadays, developed world, global climate change is having a significant impact on agriculture. As a result, it causes a number of problems, such as increased drought, changes in the growing season, and reduced yields. In our country, innovative solutions are being searched to the problems arising from global climate change, and water-saving irrigation technologies, namely drip and sprinkler irrigation, are currently being used. In addition, ideas for growing and using climate-adapted agricultural crops in the future have been put forward and are being implemented, and there are also approaches such as digital monitoring systems and improving agrotechnical measures. Today, in addition to global climate change, the drying up of the Aral Sea has also had a very negative impact on agriculture and caused serious problems, and as a result, the need to introduce new technologies and alternative crops has arisen.

In particular, the President of the Republic of Uzbekistan signed Resolution № PD-233 on June 24, 2024. This resolution established measures such as training young specialists to adapt agriculture to climate change, developing an early warning system for emergency situations , and attracting funds from international financial institutions. It is clear from this that Our President also pays serious attention to the problems arising from global climate change and is looking for innovative solutions to this problem. Global climate change remains an urgent problem not only for our country, but also for all countries . Currently, a number of innovative solutions are being sought to prevent this problem. For example, new varieties of crops and trees adapted to climate change are being created.

In addition, due to water scarcity, low-water consumption crop species are being grown in order to use less water. Efforts are being made to minimize the problems arising from global climate change through innovative solutions.

The Purpose of the article is to study all the problems that arise in agriculture as a result of global climate change and the drying of the Aral Sea and to find innovative solutions to them by analyzing these problems. These innovative solutions are aimed at preventing the damage to agriculture as a result of global climate change and the drying of the Aral Sea. By introducing new technologies, saving water and using it rationally, creating seedlings that are adapted to a hot climate, and in some places, resistant to salt and do not require much water, since the soils are saline, we will prevent the death of our seedlings during the hot climate and the Aral Sea problem.

* Corresponding author.
E-mail addresses: xxujamkulova@gmail.com (Kh.Khujamkulova) Scopus ID: 58566912700
E-mail addresses: muxsiddinovabror@gmail.com (A.Mukhsiddinov)

https://doi.org/10.5281/zenodo.17784049
Received 30 July 2025; Received in revised form 26 August 2025; Accepted 30 August 2025
Available online 1 October 2025
ISSN 2181-9408/© 2025 The Authors. Published by "TIIAME" NRU. The journal "Sustainable Agriculture" is registered in the Press Agency of Uzbekistan on the 12th of February in 2018 (license № 0957). In 2019, the journal is included in the list of recommended scientific publications by the Higher Attestation Commission of the Republic of Uzbekistan.

2. MATERIALS AND METHODS

In the article, We discuss about global climate change and the drying of the Aral Sea and their impact on agriculture. We are covering the drying of the Aral Sea separately, rather than including it in the problems caused by global climate change. Because global climate change is not the main reason for the drying of the Aral Sea, this problem is mainly one of the environmental problems caused by human activity.

This problem began in the second half of the 20th century, when the waters of the Amu Darya and Syr Darya were widely used to irrigate cotton and other crops. As a result, the area of the Aral Sea shrank sharply, and the Aralkum Desert appeared in its place, salt and dust storms intensified, negatively affecting the surrounding ecosystem and human life. As a result of the drying of the Aral Sea, salt and minerals rose into the air along with the water and settled on the surrounding fields. As a result, the soils were damaged. It became difficult to grow crops on saline soil, and productivity decreased. Additional costs were required to maintain soil fertility (for example, washing the land, planting salt-tolerant crops). The amount of water extracted from the Amu Darya and Syr Darya decreased, and its quality also deteriorated (salt and harmful substances increased in the water content). In some places, they were forced to plant crops that required less water instead of traditional crops. The Aral Sea was a factor that provided the region with a mild climate.

When it dried up, summers became hotter and winters colder. As a result of such a sharp change in the climate, the ripening period of crops changed, and some crops even died. We are considering the impact of the Aral Sea problem on agriculture, so we will also touch on the impact of this problem on livestock farming. The quality of pastures deteriorated due to the shortage of water resources, the fact that summers were very hot and winters were very cold, and the salt and harmful substances from the dried-up Aral Sea rose into the air and were blown by the wind onto pastures. Due to the lack of food and drinking water for livestock, livestock farms decreased. The drying up of the Aral Sea caused serious problems in agriculture.

To find a solution to such a huge problem, innovative innovations are being introduced, namely: the introduction of new technologies and alternative crops. Currently, methods such as hydromodification (land washing, measures against salinization), drip irrigation, and planting crops that require less water are being used on damaged and saline lands. Global climate change has primarily caused drought in many regions. For example, due to the proximity of the Kashkadarya and Surkhandarya regions to desert areas, the drought process is accelerating. As a result of the decrease in the Amudarya River, irrigation opportunities are decreasing. There is a shortage of water for cotton and grain growing. In the Bukhara and Navoi regions, precipitation is low and water resources are limited. As a result, it is becoming difficult to obtain water for irrigation, and the quality of pastures is deteriorating. In the Jizzakh and Syrdarya regions, soil moisture is decreasing as a result of climate warming. The water of the Zarafshan River is decreasing, affecting cropland.

Table 1.
Landforms resulting from the drying up of the Aral Sea.
(Compiled by the author)

Indicator	Quantity
Dry seabed area (“Aralkum Desert”)	Over 5.5 million hectares
Village on the farm to use unsuitable to be remaining crop fields	about a hectare

Global climate change is also having a significant impact on the vegetation period of plants. The vegetation period is the period of active growth and development of plants, representing the period from the moment of seed germination to the moment of harvest. This period is different for each plant species and varies depending on climatic conditions, soil fertility and agrotechnical measures. For example, for grain crops, the vegetation period lasts from spring to summer, while for fruit trees this process lasts from spring budding to autumn leaf fall. In perennial plants, vegetation begins again every year. Through this information, he wanted to highlight how important the vegetation period is for plants. Due to global climate change, this growing season is changing and many plants are dying, and there is also significant damage to crops.

3. RESEARCH RESULTS.

Through this graph, we can see all the innovations introduced between 2008 and 2023. As you can see , this graph extends to 2023, and it was in 2023 that the most innovations were introduced. These innovations have certainly contributed greatly to our development.

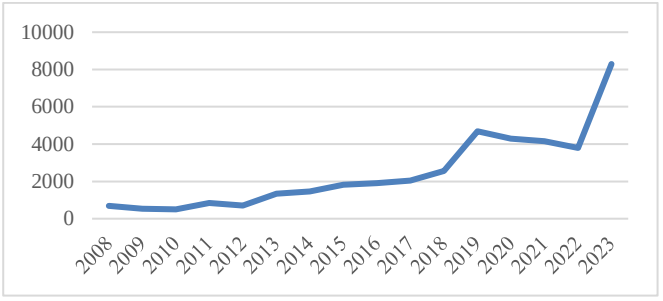


Figure 1. Number of innovations introduced by year.
(Developed by the author)

is a major environmental problem for the Republic of Uzbekistan and neighboring countries, and several international, state and local measures are being taken to address it. In order to stabilize the Aral Sea, more than 1 million hectares of saxaul and other plants have been planted, and the desert's sand drift has decreased. As a result, the amount of dust and salt spread by the winds has also significantly decreased.

According to the "Green Space" program, by 2022, more than 100 million native trees were planted in the Aral Sea regions, and the amount of salt spread to agricultural lands by soil erosion and wind has decreased. As a result of the drying up of the Aral Sea, a large water source has been lost, and as a result, we need to save and use available water resources rationally. We are trying to introduce drip irrigation and modern irrigation systems through innovative innovations.

the Amu Darya and Syr Darya effectively. As a result, irrigation systems have been modernized, and water consumption has been reduced by 40-50%. This is certainly a good result. The cultivation of agricultural crops in lands with low salinity has increased. The Aral Sea region was declared an “Ecological Innovation Zone” by the UN, and more than $200 million in investments have been attracted to environmental protection projects. At present, the restoration of the Aral Sea is almost impossible, because water flows are insufficient. For this reason, the main focus is on ecological stabilization of the region and improving the living conditions of the population. Saxaul planting and water-saving technologies have paid off. International cooperation and the development of ecotourism are contributing to the positive transformation of the region.

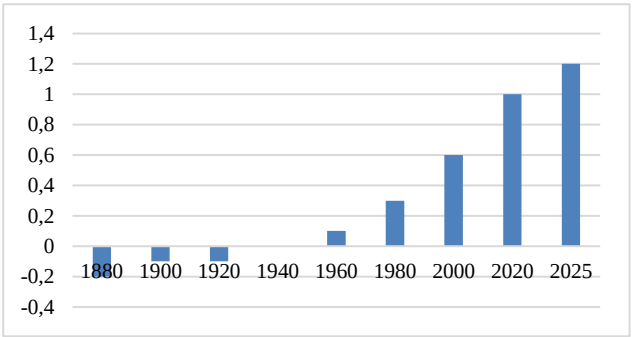


Figure 2. Global climate change. (Developed by the author)

Global climate change In the Republic of Uzbekistan, innovative technologies and advanced agricultural methods are being widely introduced to eliminate problems such as drought, water shortage, soil salinity, reduced productivity, and extreme weather conditions. For example, through a drip irrigation system, we can reduce water consumption by 40-50%. These innovative technologies are being used in the Khorezm, Kashkadarya, and Surkhandarya regions. Drones and satellite monitoring allow for the accurate delivery of water to crops. This is a very advanced technology.

This technology is currently being used in regions such as Tashkent, Jizzakh, and the Fergana Valley. In regions close to the desert zone (Karakalpakstan,), efforts have been made to combat salinization and rationally use available water resources. In addition, salt-tolerant crops have been planted in these regions. Drought-resistant wheat and rice varieties have been grown in the Andijan, Namangan, and Syrdarya regions.

Today, genetically modified crops using biotechnology are being tested. The construction of new generation greenhouses with fully automated temperature control will ensure readiness for sudden weather changes. In the Republic of Uzbekistan, effective solutions to the problems of drought, water scarcity, salinity and reduced productivity are being found and are gradually being put into practice using innovative technologies. Smart agriculture, water-saving technologies, new crop varieties, digital technologies and ecological restoration projects are helping to overcome these problems.

4. CONCLUSION:

Global climate change and the drying up of the Aral Sea pose major problems not only for the Republic of Uzbekistan, but also for neighboring countries and the world as a whole. As a result, there is a risk of a decrease in drinking water supplies worldwide. This is a major problem for all of humanity. Therefore, all countries need to work together to find solutions to these problems . Currently, Central Asian countries and major organizations, including the UN, are paying serious attention to these problems and are taking measures to solve them in innovative ways. The rational use of water resources and Drip irrigation technologies have been implemented and this project is helping to save water. Adaptation to sudden changes in weather conditions, the cultivation of new crop varieties, and the washing of saline land areas due to the Aral Sea problem and the planting of seedlings adapted to saline soils are being carried out intensively. Today, it is almost impossible to restore the Aral Sea.

Therefore, tree planting is still underway to improve the environment and prevent harm to human health. If we use modern advanced and innovative technologies, we can maximally resist global climate change and the problems of the Aral Sea.

REFERENCES

[1]“Innovative technologies in agriculture” Ahrorov F., Nurmatov N., Yusuhov E., Ganiyev I.

[2]“Agricultural Economics and Management” Samatov G. A.

[3]“Innovative organizers of increasing agricultural efficiency” Sodiq Rasulov

[4]“Ways of innovative development of agriculture in the Republic of Uzbekistan” Nafisa Akhmedova