

**“CLIMATE CHANGE AND AGRICULTURAL SUSTAINABILITY:
CHALLENGES AND ADAPTATION STRATEGIES”**

Mamajonova Zebiniso Baxtiyor qizi

Student of Namangan branch of Tashkent

University of Kimyo English education

major, 3rd level student.

Tel: +998 (95) 368 78 71

E-mail: zebinisomamajanova719@gmail.com

**“IQLIM O‘ZGARISHI VA QISHLOQ XO‘JALIGIDA BARQARORLIK:
MUAMMOLAR VA MOSLASHUV STRATEGIYALARI”**

Mamajonova Zebiniso Baxtiyor qizi

Toshkent Kimyo Xalqaro universiteti

Namangan filiali, English education

yo‘nalishi 3-bosqich talabasi.

Tel: +998 (95) 368 78 71

E-mail: zebinisomamajanova719@gmail.com

**“ИЗМЕНЕНИЕ КЛИМАТА И УСТОЙЧИВОЕ СЕЛЬСКОЕ
ХОЗЯЙСТВО: ПРОБЛЕМЫ И СТРАТЕГИИ АДАПТАЦИИ”**

Мамаджонова Зебинисо Бахтиёр кизи.

Студент Наманганского филиала

Ташкентского университета Кимё

Специальность: «Английское образование», студент 3 курса

Тел: +998 (95) 368 78 71

E-mail: zebinisomamajanova719@gmail.com

Abstract

Climate change is one of the most pressing global issues of the 21st century. It directly affects agriculture through rising temperatures, irregular rainfall, and frequent natural disasters. These changes reduce crop yields, harm soil quality, and threaten food security. At the same time, farmers are trying to adapt with sustainable practices such as water-saving irrigation, drought-resistant crops, and renewable energy. International cooperation and climate-smart farming are essential to protect rural communities and ensure long-term development.

Keywords: climate change, agriculture, food security, sustainable farming, adaptation

Annotatsiya

Iqlim o'zgarishi XXI asrning eng jiddiy global muammolaridan biridir. U qishloq xo'jaligiga haroratning ortishi, yog'ingarchilikning notekisligi va tabiiy ofatlarning ko'payishi orqali bevosita ta'sir ko'rsatmoqda. Buning oqibatida hosildorlik kamaymoqda, tuproq unumdorligi yomonlashmoqda va oziq-ovqat xavfsizligi xavf ostida qolmoqda. Shu bilan birga, fermerlar suvni tejash texnologiyalari, qurg'oqchilikka chidamli ekinlar va qayta tiklanuvchi energiya manbalaridan foydalanishga harakat qilmoqda. Qishloq xo'jaligini iqlimga moslashtirish va xalqaro hamkorlik uzoq muddatli barqarorlik uchun muhimdir.

Kalit so'zlar: iqlim o'zgarishi, qishloq xo'jaligi, oziq-ovqat xavfsizligi, barqaror dehqonchilik, moslashuv

Аннотация

Изменение климата является одной из самых серьёзных глобальных проблем XXI века. Оно напрямую влияет на сельское хозяйство через

повышение температуры, нерегулярные осадки и увеличение природных катастроф. Эти процессы снижают урожайность, ухудшают плодородие почвы и угрожают продовольственной безопасности. В то же время фермеры применяют устойчивые практики: водосберегающие технологии, выращивание засухоустойчивых культур и использование возобновляемой энергии. Международное сотрудничество и «умное» сельское хозяйство имеют ключевое значение для долгосрочной стабильности.

Ключевые слова: изменение климата, сельское хозяйство, продовольственная безопасность, устойчивое земледелие, адаптация

Introduction

Climate change is one of the biggest challenges in modern times. Greenhouse gas emissions make the Earth warmer, which causes changes in rainfall and more frequent extreme weather events (IPCC, 2021). Agriculture is very dependent on natural conditions, so it is especially sensitive to climate shifts.

In many countries, farming is not only the main source of food but also a major part of employment and rural life. Climate change threatens agricultural production and creates serious risks for food security, jobs, and economic stability. The aim of this paper is to explain how climate change affects agriculture and to show different ways of adaptation. It also discusses the importance of international cooperation and sustainable farming for future generations.

Effects of Climate Change on Agriculture

Rising Temperatures

Hotter weather reduces agricultural productivity. Crops like wheat and maize are very sensitive to heat, and their yields are falling in many regions (Lobell et al., 2011). Livestock also suffers because animals get heat stress. For example, cows produce less milk when it is too hot (Thornton et al., 2009). High temperatures also increase the spread of pests and crop diseases (Rosenzweig et al., 2014).

Unpredictable Rainfall

Rainfall is no longer stable. Some regions have long droughts, while others face heavy floods. Crops like rice, cotton, and sugarcane, which need much water, are highly vulnerable. On the other hand, too much water also damages crops because floods wash away fertile soil and reduce harvests. Central Asia already faces serious water shortages, and competition for water between farmers is growing (Sutton et al., 2013). This makes agriculture less reliable for the future.

Extreme Weather Events

Climate change also brings more hurricanes, storms, and long dry periods. These disasters damage farmland, roads, and storage buildings. According to FAO (2020), extreme weather already causes billions of dollars in agricultural losses each year. Many small farmers cannot recover after such disasters because they lose not only crops but also seeds and tools for the next season. This creates a dangerous cycle of poverty and food insecurity (Cline, 2007).

Adaptation Strategies

Climate-Resilient Crops

One solution is to grow drought- and heat-resistant crops. These crops survive with less water and can still give good harvests. In Uzbekistan, scientists are developing cotton and wheat varieties that need less irrigation (Karimov et al., 2018). Such innovations help farmers reduce risks and adapt to new conditions.

Improved Irrigation Systems

Water is the most important resource for agriculture. Old irrigation systems waste a lot of water. Modern irrigation, such as drip irrigation and sprinklers, gives water directly to plant roots and saves water. This helps farmers increase productivity even in dry areas (FAO, 2020). Governments can support farmers by making these technologies affordable (Howell, 2001).

Digital and Technological Tools

Technology is changing farming. Farmers now use satellites, drones, and mobile apps to make better decisions. For example, weather apps tell farmers the best time to plant or harvest. Precision farming tools give the exact amount of water and fertilizer that crops need (Ray et al., 2019). These tools reduce risks and make farming more efficient (Gebbers & Adamchuk, 2010).

International Cooperation

Climate change is a global problem that no single country can solve alone. International agreements such as the Paris Agreement (2015) aim to reduce emissions and help vulnerable nations. The UNDP (2020) also supports adaptation projects by funding local farmers and sharing knowledge. Stronger cooperation between countries can make agriculture more sustainable and fair.

Climate Change and Food Security

Agriculture and food security are closely connected. When crop yields fall, food prices rise, and this often leads to hunger and poverty. According to the World Bank (2019), climate change may push more than 100 million people into extreme poverty by 2030. Malnutrition is also a big risk, especially in poor countries. Sustainable agriculture is not only important for the environment but also necessary for social and economic stability (Nelson et al., 2009).

Conclusion

Climate change has a deep impact on agriculture across the world. Higher temperatures, irregular rainfall, and extreme weather reduce harvests and threaten livestock. These problems endanger food security and rural livelihoods.

However, there are solutions. Climate-resilient crops, improved irrigation, digital technologies, and strong global cooperation can help reduce risks. Protecting agriculture means protecting future generations. Therefore, governments, farmers, scientists, and international organizations must work together to build sustainable farming and support adaptation strategies.

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