MIRZO ULUG‘BEK NOMIDAGI
O‘ZBEKISTON MILLIY UNIVERSITETI
JIZZAX FILIALI



"BIOTEXNOLOGIYANING RIVOJLANISH ISTIQBOLLARI VA MUAMMOLARI"

MAVZUSIDAGI RESPUBLIKA MIQYOSIDAGI ILMIY-TEXNIK ANJUMAN TO‘PLAMI





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МИНИСТЕРСТВО ВЫСШЕГО ОБРАЗОВАНИЯ, НАУКИ И ИННОВАЦИЙ РЕСПУБЛИКИ УЗБЕКИСТАН

ДЖИЗАКСКИЙ ФИЛИАЛ НАЦИОНАЛЬНОГО УНИВЕРСИТЕТА УЗБЕКИСТАНА ИМЕНИ МИРЗО УЛУГБЕКА

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POSSIBILITIES OF INCREASING OIL CONTENT IN SUNFLOWER BASED ON CRISPR/CAS9 TECHNOLOGY

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Abstract: This thesis analyzes the potential of increasing oil content in sunflower (*Helianthus annuus* L.) using CRISPR/Cas9 technology. Sunflower is a key crop in the food industry due to its high oil content and beneficial fatty acid composition. CRISPR/Cas9 technology is an advanced biotechnology that enables precise and efficient modification of plant genomes. The thesis examines the scientific basis and practical achievements of modifying genes that negatively influence oil content, specifically the modification of FAD2, FAD3, DGAT1, and WRI1 genes. These methods can be applied to improve the quality and efficiency of sunflower cultivation.

Keywords: CRISPR/Cas9, sunflower, oil content, genetic modification, FAD2, FAD3, DGAT1, WRI1, biotechnology, plant breeding.

Ensuring global food security and increasing agricultural production are crucial challenges today. Sunflower (*Helianthus annuus* L.) is recognized as one of the most important crops for oil production. One of the primary goals in sunflower cultivation is to increase its oil content. Today, modern biotechnologies, especially CRISPR/Cas9, provide the opportunity to precisely and effectively modify the genetic makeup of plants. This thesis explores the potential of using CRISPR/Cas9 technology to increase oil content in sunflower by knocking out genes that negatively affect oil synthesis.

Importance of Food Security and Sunflower Cultivation: Sunflower is an oilseed crop that plays a significant role in the food industry. It is widely cultivated for its high oil content and beneficial fatty acid composition. Despite its advantages, the oil content in sunflower is limited by existing selection and agronomic methods. Genetic modifications using technologies like CRISPR/Cas9 are necessary to improve oil production processes and enhance plant efficiency [3-5]

Scientific Foundations of CRISPR/Cas9 Technology: CRISPR/Cas9 technology is based on a natural immune system discovered in bacteria. This system allows for precise and efficient editing of genetic material. The CRISPR/Cas9 system consists of two main components: a guide RNA (gRNA) and the Cas9 enzyme. The gRNA recognizes the nucleotide sequence of the target gene and directs the Cas9 enzyme to the specified location, where it cuts both strands of DNA. This method allows for the inactivation or modification of targeted genes. [1-2]

Genes that Negatively Affect Oil Content and Their Knockout: There are several genes that can be edited or knocked out to increase oil content in sunflower. Key genes that influence oil content include FAD2, FAD3, DGAT1, and WRI1. These genes play essential roles in synthesizing and accumulating fatty acids in plants. Modifying these genes can optimize the quantity and composition of oil in sunflower. [3-5]

Research on Increasing Oil Content in Sunflower Using CRISPR/Cas9 Technology: Recent research shows the achievements of CRISPR/Cas9 technology in modifying plant genomes. A number of studies have been conducted to increase oil content in sunflower. For example, editing the DGAT1 gene using CRISPR/Cas9 significantly increased oil content in sunflower plants. Additionally, modifications to FAD2 and FAD3 genes have been effective in optimizing oil composition. [3-4]

Conclusion: In conclusion, the application of CRISPR/Cas9 technology in sunflower (Helianthus annuus L.) offers significant potential to enhance oil content by targeting and modifying key genes that influence oil synthesis. Sunflower, with its high oil yield and beneficial fatty acid composition, is a critical crop for the food industry. However, the oil content in sunflower has been traditionally limited by conventional breeding and agronomic methods. CRISPR/Cas9, as an advanced biotechnology tool, provides a precise and efficient way to alter the genetic structure of plants, enabling the knockout of genes like FAD2, FAD3, DGAT1, and WRI1, which negatively impact oil production.

Research has shown that by targeting these genes, oil content and composition in sunflower can be optimized, leading to higher yields and improved quality. Studies have demonstrated successful applications of CRISPR/Cas9 in modifying the FAD2, FAD3, and DGAT1 genes, resulting in increased oil production in sunflower plants. This breakthrough in biotechnology paves the way for more efficient and sustainable agricultural practices, addressing the growing global demand for oilseed crops.

The future of sunflower breeding lies in the integration of CRISPR/Cas9 technology with traditional breeding methods, enabling the development of

sunflower varieties with superior oil content. As a result, this research opens new avenues for improving food security, enhancing agricultural productivity, and contributing to the advancement of biotechnological applications in plant breeding

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CTLA-4 GENI POLIMORFIZMILARI VA QANDLI DIABETNI ERTA TASHXISLASH

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Annotatsiya: 1-turdagi qandli diabet (1TQD) insulin ishlab chiqaruvchi beta hujayralarining yo‘qolishi bilan yuzaga keladigan autoimmun kasallikdir. 1TQD rivojlanishiga genetik va atrof-muhit omillari ta'sir qiladi, bunda immun tizimining noto‘g‘ri ishlashi muhim rol o‘ynaydi. CTLA-4 geni immun tizimining faoliyatini boshqarib, autoimmun kasalliklar, jumladan 1TQDda ham ishtirok etadi. CTLA-4 polimorfizmlari immun tizimidagi o‘zgarishlarga olib kelib, kasallikning rivojlanishiga ta'sir ko‘rsatishi mumkin. Ushbu tadqiqotlar natijasida CTLA-4 polimorfizmlarining autoimmun kasalliklar, ayniqsa, 1-turdagi qandli diabetning rivojlanishidagi o‘rni va ahamiyati to‘g‘risida chuqurroq tushunchaga ega bo‘lish mumkin. CTLA-4 polimorfizmlarining diagnostik marker sifatida ishlatilishi,