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COTTON (G‘O‘ZA) BIOLOGY AND VARIETIES

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Abstract: Cotton (Gossypium spp.) is one of the most important industrial crops in the world, providing natural fiber, edible oil, and protein-rich byproducts. Understanding its biological characteristics and varietal diversity is critical for improving yield, fiber quality, and resistance to biotic and abiotic stresses. This study reviews the biological features of cotton, its growth stages, genetic diversity, and the main characteristics of popular varieties cultivated in Uzbekistan and other cotton-producing countries.

Keywords: cotton biology, Gossypium hirsutum, varieties, fiber yield, breeding, Uzbekistan.

Introduction

Cotton (Gossypium spp.) is one of the most ancient and economically significant crops cultivated by humans. Archaeological evidence indicates that cotton cultivation dates back more than 5,000 years, with early origins traced to the Indus Valley, Egypt, and Central America. Today, cotton remains a cornerstone of the global textile industry and serves as a critical component of agricultural economies, particularly in developing countries such as Uzbekistan, India, China, Pakistan, and Brazil. Beyond its importance for fiber production, cotton also provides edible oil and protein-rich meal for livestock feed, which further enhances its agricultural value.

The biology of cotton is characterized by complex physiological and morphological traits that determine its growth, reproduction, and yield potential. As a perennial plant cultivated annually, cotton undergoes distinct developmental stages—germination, vegetative growth, flowering, boll formation, and maturation—each influenced by environmental conditions such as temperature, humidity, soil fertility, and irrigation. Understanding these biological processes is essential for optimizing agronomic practices, ensuring sustainable production, and improving fiber quality.

From a genetic perspective, the genus Gossypium comprises more than 50 species, but only four are domesticated for fiber production: G. hirsutum (upland cotton), G. barbadense (Egyptian or Pima cotton), G. arboreum, and G. herbaceum. G. hirsutum is the most widely cultivated, accounting for nearly 90% of global production due to its adaptability, high yield, and good fiber properties. G. barbadense is valued for its superior fiber length and fineness, though it is less tolerant to harsh climates. The remaining two species are mainly grown in specific regions of Asia and Africa for their resistance to pests and drought.

In Uzbekistan, cotton—known locally as “oq oltin” or “white gold”—has been a symbol of agricultural and economic prosperity for decades. The country’s diverse climatic zones, ranging from the humid Fergana Valley to the arid Kyzylkum region, have necessitated the development of region-specific cotton varieties. Research institutions such as the Uzbek Research Institute of Cotton Breeding and Seed Production have played a crucial role in producing high-yielding and stress-resistant cultivars through hybridization and selection. Examples include “Bukhara-6,” “Sulton,” “Namangan-77,” and “Andijan-35,” which are recognized for their adaptability, early maturity, and resistance to common diseases like verticillium wilt and fusarium wilt.

In recent decades, the integration of biotechnology and molecular genetics into cotton research has opened new horizons for improving plant performance. The identification of genes responsible for fiber elongation, drought tolerance, and pest resistance has accelerated the

breeding of transgenic and hybrid cotton varieties. These innovations not only contribute to higher productivity but also reduce environmental impact by minimizing the use of chemical pesticides and water resources.

Given the economic, ecological, and social importance of cotton, studying its biology and varietal diversity remains a key priority in agricultural science. This study aims to analyze the biological characteristics of different cotton species and varieties cultivated in Uzbekistan, focusing on their morphological, physiological, and genetic features. The research also explores the potential of new breeding approaches to develop sustainable cotton varieties that meet the demands of modern agriculture and the global textile industry.

Materials and Methods

This study was conducted using comparative analysis of biological and agronomic characteristics of different cotton varieties cultivated in Uzbekistan between 2015 and 2024. The data were collected from experimental fields of the Andijan and Tashkent Agricultural Institutes. Morphological traits such as plant height, number of bolls per plant, boll weight, and fiber length were measured during the flowering and maturation periods.

Statistical analysis was performed using the ANOVA method to determine the significance of differences between varieties. Additionally, literature reviews and genetic reports from the International Cotton Advisory Committee (ICAC) and Uzbekistan's Cotton Research Institute were analyzed to evaluate varietal diversity and adaptability.

Results

The results showed significant variation among the studied varieties in terms of plant morphology and productivity indicators. The average plant height ranged from 95 cm (Andijan-35) to 135 cm (Sulton). The number of bolls per plant varied from 12 to 18, and the average boll weight was between 5.2 and 6.8 grams.

Fiber length and quality were found to be highest in G. barbadense derivatives, such as "Bukhara-6", with an average fiber length of 37–40 mm and high tensile strength. Early-maturing varieties like "Andijan-35" reached harvest readiness 7–10 days earlier than other cultivars, which is advantageous in regions with shorter growing seasons.

Furthermore, drought and salinity tolerance were observed in some experimental hybrids developed through interspecific crosses of G. hirsutum × G. barbadense. These hybrids demonstrated stable performance under the arid conditions typical of Uzbekistan's Fergana Valley.

Discussion

The findings confirm that varietal selection based on biological adaptability plays a key role in sustainable cotton production. The genetic diversity within Gossypium species provides opportunities for improving yield stability and stress resistance. Breeding programs in Uzbekistan have successfully integrated classical hybridization with modern biotechnological tools such as molecular marker-assisted selection and genome mapping.

Environmental factors such as temperature, soil salinity, and water availability were shown to significantly affect growth and fiber development. Therefore, developing eco-adapted varieties

remains a strategic priority. The combination of biological research, agronomic trials, and genetic studies ensures the continuous improvement of cotton productivity and fiber quality.

Conclusion

The study highlights the importance of understanding cotton biology and varietal diversity for the effective management of cotton cultivation. Uzbek cotton breeding has made substantial progress by developing varieties that combine high yield, superior fiber quality, and resilience to environmental stress. Future research should focus on integrating molecular genetics, sustainable farming practices, and precision agriculture technologies to further enhance cotton production efficiency.

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