HIGH YIELD FACTORS FROM LIGHT COLORED GRAY SOILS OF KASHKADARYA REGION

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Abstract

This article presents the results of scientific research on irrigation and fertilization rates in the conditions of light gray soils of the Kashkadarya region using the technology of cultivating cotton of the Bukhara-6 variety.

Key words: Variety, soil, moisture, water, irrigation, fertilizer, limited field capacity, level and system.

Introduction

Growing a early-term cotton crop in our country is one of the most pressing issues today. The scope of scientific research in this area is being expanded in our country.

Moreover, various agro-technologies for the cultivation of cotton varieties are being tested in the soil and climatic conditions of each region and introduced to farms. This is due to the fact that cotton varieties created in different soil-climatic conditions grow, develop and yield differently in other regional conditions, and fiber qualities also change.

Therefore, the main focus was on the creation of new early maturing varieties of cotton in accordance with the soil and climatic conditions of the regions and the production of agro-techniques for their cultivation.

Determining the optimal irrigation and feeding regimes for new promising and regionalized cotton varieties plays an important role in the overall agro-technical complex. This is because, depending on the soil and climatic conditions, this or that variety of cotton differs to a certain extent according to the requirements of the external environment.

Field experience was carried out in the Kasbi district of Kashkadarya region A. The Goziev farms were operated on light gray soils with deep groundwater.

The experiment consisted of 6 options (3 nutrient criteria, 4 irrigation regimens), and the irrigated area for each irrigation regime was 5760 m2. The annual amount of mineral fertilizers(M: R: K)in variants 1-3 is 140: 100: 70 kg, in variants 2-5 - 180: 125: 90 kg, and in variants 4-6 - 220: 155: 110 kg. marked.

Nitrogen from mobile nutrients at the beginning of the period was 10.04 mg kg in the0-30 cmlayeron the common bottom, 3.92 mg kg in the 30-50 cm layer, while the phosphorus content was 14.7 mg kg in the 0-30 cm layer, 30-50 7.5 mg kg per cm, the potassium content was 220 and 200 mg kg, respectively. Irrigation during the growing season of cotton The amount of mineral fertilizers changed in different amounts in the soil layer under the influence of agro technical processes.

The demand of crops for soil moisture was different, and on this basis, the conditions of growth and development also changed. Experimental cultivated cotton variety "Bukhara-6" irrigated on the basisof 65-65-60% soil moisture 1-3 options 1-1-1 3 times, before irrigation the soil moisture level is keptin the range of 70-70-60% to ChDNS 2 In variants -5 watered 4 times with 1-2-1 system, soil moisture waskept5timeswith1-3-1systemin4-6variantskeptaround70-75-60%.Irrigationwaterwas820.5- 1200.4 m3 in options 1-3, 703.6-1116.7 m in options 2-5 and 703.6-1050.8 m3 in options 4-6.

According to the options, the total amount of irrigation water supplied during the season is 3171.7 per hectare in accordance with the options arrangement; 3811.3; 4645.7 and 5042.1 m3, respectively. The period between irrigations is 29-37 according to the above case; 21-39; 18-36 and 15-35 days respectively.

The lowest irrigation of cotton was carried out within the limits of soil moisture 65-65-60%, irrigated 3 times on the basis of 1-1-1 system, 3171.7 m3 of water per season, 140 kg of nitrogen per hectare of mineral fertilizers, 100 kg of phosphorus, 70 kg potassium was observed in option 1. Accordingly, the number of harvested branches and stalks was also low. Therefore, in the1st variant, as ofSeptember1, the height of cotton was 73.4 cm, the number of branches was 15.1, the number of pods was 8.5. In variant 2, which is increased to 75.0 cm, 15.6 and 9.0 pieces, respectively, the amount of mineral fertilizers is increased to 220, 155, 110kg, respectively, invariant 3, which is increased to 76.0cm,

16.0 and respectively. Was equal to 9.4 units. As of September 1, the number of open wells was 5.3,

5.2 and 5.0, respectively.

The highest growth and development of cotton was observed in variant 6, when 220 kg of nitrogen,155 kg of phosphorus and 110 kg of potassium per hectare of mineral fertilizers were applied with the introduction of an optimal irrigation system (soil moisture was maintained at 75-75-60% before irrigation). , 8 cm, the yield horn was 20.5, the number of pods was 11.5, of which 6.3 were opened. In the same irrigation conditions, the reduction of the amount of mineral fertilizers by 40, 30, 20 kg, respectively (option 4) slightly reduces the growth of cotton and the number of harvested branches (92.4 cm and 20.2 pieces), the number of pods (11.8 pieces, the same including 6.4 units). Further reduction of the amount of mineral fertilizers (140; 100; 70 kg, respectively) in the 2nd variant of the experiment had a negative impact on the growth and development of cotton.

The most optimal condition for growth and development is irrigation, which is carried out at a field moisture of 70-75-65% of the soil, nitrogen from mineral fertilizers 180 per hectare; phosphorus 125 and potassium 90 kg were observed in variant 3, in which the length of the cotton was 88.3 cm, the yield of branches was 18.8, the number of cocoons was 14.9, of which 8.2 were opened.

Based on the analysis of the above indicators, it can be said that the reduction or increase of field moisture in irrigation and the norm of mineral fertilizers from this acceptable amount did not have a positive effect on the growth and development of cotton.

Irrigation was carried out at a soil moisture content of 70-70-65%, and 220 kg of nitrogen, 155 kg of phosphorus and 110 kg of potassium per hectare of mineral fertilizers were applied, but the growth of cotton was not high. The amount of mineral fertilizers in a certain irrigation regime is 40 per hectare, respectively; Reduction from 30:20 kg ensured high yield of elements in the cotton variety "Bukhara- 6".

Analysis of the cotton yield obtained this year from the cotton variety "Bukhara-6" shows that the minimum yield in the 1-3 variants of the experiment (29.7-31.3 ts / ha) is 65-65-60% of the soil moisture before irrigation according to ChDNS, Irrigated 3 times with 1-1-1 system, a total of 3171.7 m of water was used per hectare and 140, 180 and 220 kg of nitrogen, 100, 125, and 155 kg of phosphorus, 70, 90 and 110 kg of potassium were obtained from mineral fertilizers per hectare.

Most cotton yields were irrigated 5 times with a 1-3-1 system at 70-75-60% soil moisture relative to ChDNS. 4645.7 cubic meters of water were used per hectare and 180 kg of nitrogen, 125 kg of phosphorus and 90 kg of potassium per hectare were obtained from mineral fertilizers. The total harvested yield was 31.8 per hectare in each harvest; 16.4 and 8.4 quintals, the gross yield was 56.6 quintals.

The results of the analysis of irrigated cotton yield showed that the highest amount of water used for growing on equintal of cotton was invariant 2 of the study (111.4m3), and the lowest water consumption was in variant 4 with high cotton yield (82.1).m3)was observed. The results of the study show that the implementation of irrigation in a science-based system has allowed to save the usual amount of water supplied during the season, while providing the highest yield (variant 6) in the care of medium-fiber cotton variety "Bukhara-6".

Thus, in order to obtain the highest quality cotton of the medium-fiber variety "Bukhara-6" (56.6 ha) during the period of operation with a 1-3-1 system using 4645.7 m3 of water 5 times irrigation and mineral fertilizers 180 per hectare. kg of nitrogen, 125 kg of phosphorus, 90 kg of potassium is advisable. In this case, the minimum amount of water (82.1 m3 ts) per 1 quintal of cotton will be used, an additional 26.9 quintals per hectare will be created, and the most favorable conditions will be created for obtaining 3.3 quintals of cotton in excess of this fertilization rate.

Concept of High Yield Factors

The concept of high-yield factors in agriculture refers to the key elements that maximize crop and livestock productivity, ensuring higher food production and profitability. These factors include the use of improved seed varieties, proper soil fertility management, effective irrigation, and pest control strategies. Farmers who adopt high-yield techniques can significantly increase their output while maintaining sustainability. With the rising global demand for food, incorporating these factors is essential in modern farming practices. One of the most critical high-yield factors is the **selection of quality seeds and breeds**. High-yielding crop varieties, such as hybrid and genetically modified seeds, are engineered to produce more grains, resist pests, and adapt to various environmental conditions (Balmford & Amano 2018). In livestock farming, selecting improved animal breeds for dairy, meat, or egg production ensures higher productivity. By investing in superior genetic material, farmers can achieve higher yields with fewer inputs, increasing overall efficiency.

Another crucial factor is **resource management**, including soil fertility, water supply, and mechanization. Proper soil testing and the use of organic and inorganic fertilizers help maintain soil nutrients, leading to better plant growth. Efficient irrigation systems, such as drip irrigation, ensure crops receive adequate water, even in dry seasons. Additionally, modern farming technologies, such as tractors, drones, and artificial intelligence, optimize farm operations, reducing labor costs and enhancing productivity (Balmford, & Zu 2023). Lastly, **pest and disease control, as well as economic and environmental considerations**, play a significant role in high-yield agriculture. Integrated Pest Management (IPM) strategies help reduces crop losses due to pests while minimizing environmental damage. Climate-smart agricultural practices, such as crop rotation and greenhouse farming, ensure sustainable production despite climate challenges.

Concept of Light Colored Gray Soil

Light-colored gray soil, often referred to as gray forest soil or podzolic soil, is a type of soil that is characterized by its pale grayish hue, low organic matter content, and unique mineral composition. These soils typically form in temperate climates with moderate to high rainfall, commonly found in boreal and temperate forests, especially under deciduous or mixed forests. The gray coloration results from intense leaching processes that remove nutrients and organic material from the upper soil layers, leaving behind a lighter, mineral-rich horizon.

One of the defining characteristics of gray soil is its podzolization process, in which rainfall percolates through the soil and washes away essential nutrients, iron, and aluminum oxides. This process leads to the development of distinct soil horizons: a bleached E-horizon (eluviation layer) and a reddish-brown B-horizon (illuviation layer), where the leached minerals accumulate. The loss of organic matter and essential minerals in the upper layers makes these soils naturally acidic and less fertile compared to darker soils, which retain more humus and nutrients. Despite their low natural fertility, light-colored gray soils can still be utilized for agriculture with appropriate soil management practices. Farmers often apply lime and fertilizers to neutralize acidity and replenish essential nutrients like nitrogen, phosphorus, and potassium. In regions where these soils are predominant, crops such as wheat, rye, oats, and barley are commonly grown, as they are more tolerant of acidic and nutrient-poor conditions (Buol, 2011). However, without proper soil amendment and crop rotation strategies, agricultural productivity on gray soils can decline over time due to further nutrient depletion. Ecologically, light-colored gray soils play an essential role in forest ecosystems by supporting tree growth, regulating water movement, and acting as a habitat for soil microorganisms. The leaching process that forms these soils also influences groundwater quality by filtering certain minerals while allowing acidic compounds to move deeper into the soil profile. Due to their sensitivity to erosion and degradation, sustainable land management techniques—such as afforestation, controlled grazing, and organic matter enrichment—are crucial for maintaining the ecological balance in regions with gray soils.

Types of High Yield Factors

Achieving high agricultural yields is essential for food security, economic growth, and sustainable farming. Various factors influence crop productivity, including environmental conditions, soil fertility, crop variety, irrigation methods, and modern technological advancements.

- ❄ **Environmental and Climatic Conditions**

Environmental and climatic conditions significantly influence agricultural productivity by affecting soil moisture, crop metabolism, and overall yield stability. Temperature fluctuations, precipitation variability, and extreme weather events such as droughts and floods directly impact plant growth and food production.

❄ Soil Fertility and Nutrient Management

Soil fertility and nutrient management are essential for maximizing agricultural productivity by ensuring optimal plant growth and soil health. Integrated Nutrient Management (INM), which combines organic and inorganic fertilizers, enhances soil structure and nutrient availability, leading to higher crop yields Hu et al. (2025) studied nitrogen fertilizer applications in wheat production and found that optimized nitrogen levels improve crop lodging resistance and yield quality. Zargar Yaghoubi et al. (2025) also examined how water and fertilizer stress affect maize production, highlighting the need for balanced nutrient application.

❄ Irrigation Techniques and Water Management

Efficient irrigation techniques and water management are crucial for optimizing agricultural yield, especially in regions facing water scarcity. Advanced irrigation methods such as precision irrigation, drip irrigation, and IoT-based water management systems help conserve water while improving crop productivity. Degfachew et al. (2025) demonstrated how irrigation and water resilience strategies improve crop yields in Ethiopia's drylands. Julisna & Prasetyo (2025) also explored water-stressed environments and the impact of irrigation techniques on yield performance.

❄ Seed Quality and Crop Varieties

Seed quality and crop variety selection are fundamental to maximizing agricultural yields by ensuring better germination rates, pest resistance, and adaptability to environmental conditions. High-quality seeds with improved genetic traits significantly enhance productivity and resilience against climate stressors. Aiono & Kader (2025) evaluated improved tomato genotypes that enhance yield and pest resistance. It was analyzed transcription factors regulating rice anther development, highlighting their potential for improving crop breeding (Miglani et al, 2025).

❄ Technology and Precision Agriculture

Technology and precision agriculture have revolutionized modern farming by enhancing efficiency, optimizing resource use, and improving crop yields. Advanced tools such as IoT-enabled sensors, drones, and AI-driven data analytics allow farmers to monitor soil conditions, detect diseases early, and optimize irrigation and fertilization processes Joshi et al. (2025) introduced a new breeding technique, "3PaTec," which utilizes polyspermy-induced triparentage to enhance crop yields.

❄ Pest and Disease Management

Effective pest and disease management is crucial for maintaining high agricultural yields by minimizing crop losses and ensuring plant health. Integrated pest management (IPM) strategies, including biological control, resistant crop varieties, and precision monitoring, have been shown to significantly reduce pest-related yield losses.

❄ Agroforestry and Sustainable Practices

Agroforestry and sustainable agricultural practices play a significant role in enhancing crop yields while promoting environmental conservation. Donkor et al. (2025) examined how homegarden commercialization in Ghana contributes to food security and sustainable agriculture. By integrating trees, crops, and livestock in a single farming system, agroforestry improves soil fertility, enhances biodiversity, and mitigates climate change impacts. Comath et al. (2025) explored biochar applications in soil remediation and crop productivity enhancement.

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