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Fertilization and Irrigation Technology in a Double-Row (76×10 cm) Scheme Based on New Intensive Agrotechnology under the Conditions of Samarkand Region

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Abstract: At the Samarkand Scientific Experimental Station, in 2025, Xin Lu Zao-78 cotton variety was planted in double rows under the film with a row spacing of 76x10 based on foreign technology. Stom-P Original 33% k.e. containing 330 g/l of pendimethalin was sprayed against weeds. Before sowing, 80-100 percent of the annual rate of phosphorus fertilizers (250-300 kg/ha in physical form of ammophos) and 80-100 percent of potassium fertilizers (100-120 kg/ha of potassium chloride) were applied under the chisel-harrow. Water-soluble NPK fertilizers were applied in solution through drip irrigation according to the recommendations. During the season, irrigation was carried out at a rate of 930-1155 m³/ha.

Keywords: soil, water and fertilizer, cotton varieties, habitat, irrigation standards, application of agrotechnologies, climatic conditions, drip irrigation

Introduction

At present, the rational use of resources in agricultural production, obtaining high and stable yields, and maintaining ecological balance are among the important tasks. Cotton growing is one of the leading sectors of agriculture in Uzbekistan and occupies an important place in the country's economic development. At the same time, the use of traditional agrotechnologies in cotton cultivation leads to problems such as low productivity, inefficient use of water and fertilizer resources, and a decline in soil fertility [1].

By the President of the Republic of Uzbekistan, Sh. Mirziyoyev, special attention is being paid to cotton growing, which is one of the important branches of agriculture, and large-scale reforms are being implemented. In increasing cotton productivity, it is required to introduce the foundations of science and achievements of technology, mainly giving great attention to seed production. In this regard, according to the Resolution of the President "On additional measures to develop the seed

production system in cotton growing and to increase cotton yield" No. PQ-391 dated December 15, 2023, permission was granted to plant and cultivate foreign cotton varieties on up to 10% of the cotton areas of the republic on a trial basis [2].

Based on this resolution, agro-clusters have been importing and cultivating seeds of cotton varieties from India, Turkey, and China that are resistant to various diseases, pests, and drought, and have high yield, fiber output, and quality (Xin Lu Zao-78, Xin Lu Zao-52, Zhongmian-88, Chintay-2, Hech-6, Nech-21, Elize, Livzara, Milet-84, Maya). Considering that Uzbekistan ranks 25th among the countries of the world in terms of water scarcity and that 49–53% of irrigated lands in the republic are affected by salinity to varying degrees, it is necessary to transition to water-saving irrigation technologies, reduce the amount of water used for leaching salts, and ensure the sustainable development of agricultural production through the development and implementation of innovative technologies that improve the reclamation condition of lands [3], [4].

Therefore, under conditions of global climate change, in order to obtain stable and guaranteed yields from agricultural crops, it is required to effectively use modern scientific achievements to reduce the impact of high temperatures, water scarcity, soil salinity, various diseases and pests, as well as other stress factors.

Materials and Methods

In the current year, due to the complexity of climatic conditions and the lower amount of precipitation compared to previous years, it is undoubtedly required to sow cotton seeds in April within a short period, making use of the natural soil moisture, ensuring proper soil conditions, and paying special attention to cotton cultivation practices. Based on these conditions, in the specific climatic conditions of the Samarkand region, it is important to consistently implement all intensive agrotechnical measures to obtain high and quality cotton yields [5].

At the Samarkand Scientific Experimental Station of the Scientific Research Institute of Cotton Breeding, Seed Production, and Agrotechnologies (PSUEAITI), in 2025, cotton was cultivated on a total area of 19.6 hectares. Based on foreign technology, using a double-row (76×10 cm) scheme under film with drip irrigation, the high-yielding cotton variety Xin Lu Zao-78, imported from China and considered resistant to various diseases and pests (including bollworm), was planted on 4.4 hectares.

To prevent the lifting and perforation of the film caused by weeds, which leads to evaporation of soil moisture under the film, a decrease in temperature, and delayed seedling development, Stomp-P Original 33% EC, containing 330 g/L pendimethalin, was applied against weeds before sowing [6]. Before planting, 75% of the annual norm of phosphorus fertilizers (in physical form, ammophos 200 kg/ha) and 50% of potassium fertilizers (potassium chloride 35 kg/ha) were applied under chisel-harrow cultivation. The application of water-soluble NPK fertilizers through drip irrigation in solution form was carried out according to recommendations.

In this process, according to the growth stages of cotton: at the stage of 2–4 true leaves, pure nutrients were applied at rates of N–35, P–25, K–10 kg/ha; during the budding stage, in two applications, N–35, P–20, K–20 kg/ha; during the flowering phase, in four applications, namely: in the first and second applications, N–40, P–20, K–15 kg/ha; in the third application, N–15, P–20, K–10 kg/ha; and in the fourth application, P–15, K–10 kg/ha. During the season, fertilizers were applied at a total rate of N125P300K100 [7]. Under drip irrigation, the loss of nitrogen fertilizers decreases and their use efficiency increases, and since nutrients are delivered in a dissolved form directly to the root zone, the coefficient of root uptake increases.

Drip irrigation was carried out 1–2 times in the second half of May and the first half of June, taking into account soil moisture, with water consumption of 180–225 m³/ha per irrigation and intervals of 8–10 days. In July, when cotton entered the flowering and yield formation stages, considering the acceleration of growth and the increase in air temperature, irrigation norms were increased and intervals shortened, that is, irrigation was carried out every 4–5 days, and subsequent irrigations every 5–7 days, with a rate of 300–375 m³/ha per irrigation [8], [9]. In August, irrigation was carried out 3–4 times with a rate of 300–375 m³/ha per irrigation, with intervals of 7–9 days. In September, drip

irrigation was carried out once at a rate of 150–180 m³/ha. During the growing season, irrigation was conducted at a total rate of 930–1155 m³/ha.

Result and Discussions

The implementation of a double-row (76×10 cm) planting scheme under film with drip irrigation demonstrated stable crop establishment and uniform vegetative development of the Xin Lu Zao-78 cotton variety under the specific climatic conditions of the Samarkand region. The applied agrotechnical measures, including optimized sowing parameters and staged nutrient supply, contributed to improved plant height, leaf formation, and development of fruiting branches. The regulated application of water-soluble NPK fertilizers through drip irrigation ensured a consistent nutrient supply directly to the root zone, which enhanced nutrient uptake efficiency and reduced potential losses, particularly of nitrogen [10], [11].

Irrigation scheduling adapted to crop growth stages and climatic conditions supported efficient water use. The gradual increase in irrigation frequency and volume during peak growth and reproductive stages corresponded with increased plant demand, resulting in improved physiological activity and yield formation. The total seasonal irrigation norm of 930–1155 m³/ha indicates a relatively efficient use of water resources under conditions of limited precipitation and high evaporative demand.

The use of herbicide prior to sowing effectively reduced weed competition, thereby preventing negative effects on soil moisture retention and seedling emergence under film conditions [12]. In addition, the integration of intensive agrotechnologies, including pest-resistant varieties and controlled input application, contributed to maintaining crop health and stability of production.

From a theoretical perspective, the study confirms that the integration of precise planting geometry, controlled nutrient delivery, and adaptive irrigation management forms a synergistic system that enhances resource use efficiency and crop productivity. Practically, the results demonstrate that the adoption of drip irrigation under film can serve as a viable approach for mitigating water scarcity and soil salinity challenges in arid regions [13].

However, a knowledge gap remains regarding the long-term effects of such intensive systems on soil properties, including salinity dynamics, microbial activity, and nutrient balance. Additionally, comparative data on different foreign cotton varieties under identical conditions are limited.

Further research should focus on multi-year field experiments to evaluate sustainability, detailed economic analysis of input-output efficiency, and the optimization of fertilizer regimes under varying environmental conditions [14], [15]. Investigations into soil health, water productivity indices, and digital monitoring technologies for irrigation and nutrient management would further enhance the effectiveness of intensive cotton production systems.

Conclusion

The cotton sowing seeder technique and its main parameters (sowing depth, soil hardness, and spacing) directly affect vegetative development and the uniform growth of seedlings. Optimal technical parameters reduce competition between plants and ensure the efficient uptake of water and nutrients from the soil. The combination of drip irrigation and optimal plant density improves plant height, number of leaves, and the development of fruiting branches. This condition, especially in a system of irrigation under film, increases productivity through the stable supply of water and nutrients.

In a drip irrigation system under film, the seasonal and stage-by-stage application of mineral fertilizers (N, P₂O₅, K₂O) maximizes the development of vegetative and generative organs of cotton. This not only increases yield but also contributes to the efficient use of water and fertilizers. In intensive technology, monitoring and control of weeds and pests protect cotton growth and yield elements. Through this, high yield levels are maintained and economic efficiency increases.

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