

Article

## Properly Implemented Agrotechnics in Cotton Care are the Key to Economic Efficiency

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**Abstract:** An examination takes place to determine how defoliant, irrigation frequencies and fertilizer amounts affect S-8286 cotton development and yield specifically within Samarkand's meadow-gray soils of Uzbekistan. The field of defoliant optimization research exists independently from investigation into the regional connections between irrigation methods and fertilizer applications. Field experiments with randomized blocks contain two irrigation systems (65-65-60% and 70-70-60%) and mineral fertilizer amounts (N-250, P<sub>2</sub>O<sub>5</sub>-175, K<sub>2</sub>O-125 kg/ha) evaluated UzDEF defoliant at 8.0 l/ha. A yield enhancement of 3.7 t/ha reached 38.6 t/ha occurred under the higher level of irrigation (70-70-60%) which resulted in better economic outcomes. Research showed that UzDEF application achieved both better defoliation effects and yield improvement without requiring additional expenditures. The profit margin reached 38.9% when farmers used ideal cultivation practices instead of the former 34.1% with less watering. The research establishes that combining water management with nutrient management creates ideal conditions to maximize cotton productivity while boosting economic results at the field scale. The experimental findings offer concrete guidelines to cotton growers about the proper use of scientifically supported defoliant which enhances production efficiency together with sustainable stewardship of the fields. Research should investigate how soil condition evolves after defoliant usage and how these changes affect fiber quality in the cotton crop.

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### 1. Introduction

A plant organism conducts vital activities because of complex biochemical development which depends entirely on environment variables. The field of plant breeding continues to adopt various chemical agents at an escalating rate in modern times. Many mineral fertilizers along with various insecticides, fungicides and herbicides that protect crops from pests and diseases and transphyts and defoliant and desiccants used for pre-harvest plant operations are extensively utilized in agriculture.

Cotton production quantity along with quality improvement relies on three key factors: timely water supply and proper mineral fertilizer provision followed by appropriate defoliant usage per scientific recommendations. The phenylurea group containing thididuron-diuron products represent the main cotton-friendly preparations used today. The scientific understanding of new defoliant remains incomplete when studying their most effective application methods and timing particularly in relation to cotton cultivation under different Uzbek Republic soil conditions and climates.

The agricultural sector of Uzbekistan as well as many other nations depends heavily on cotton which stands among the top industrial crops worldwide. High-quality cotton fiber demand keeps rising so managers need to optimize cultivation practices to enhance yield together with fiber qualities. The need to improve both irrigation precision and nutrient management methods becomes essential because of changing climate patterns and reduced availability of water resources. Defoliant has proven their value as an effective solution for agricultural management that helps establishments collect their produce at optimal times while delivering better fiber quality while decreasing manual labor needs.

Defoliant was proven effective in the previous studies for mechanical harvesting through accelerated leaf drop and lower quantities of green leaves found on harvested cotton. Research on defoliant principally concentrates on commercial imported defoliant while investigating UzDEF which represents local alternative defoliant remains minimal. The high expenses from chemical usage in Uzbekistan call for local cost-efficient solutions that fit its specific soil conditions and climate pattern.

K.A. Timiryazev described agricultural science as a discipline which focuses on using artificial methods to manage vital plant factors to achieve high yields because this is a fundamental aspect of agricultural science. The examination of defoliant effectiveness requires evaluation concerning cotton variety fertilization standards and irrigation practices under different soil-climate settings in our republic.

The study aims to establish optimal use standards and terms for affordable local defoliant which will be provided to all farmers and farms. This project brings novelty because it tests the first application of the local affordable defoliant UzDEF on S-8286 cotton variety under different irrigation schedules and levels of fertilization to determine appropriate application amounts and times. This study aims to discover the optimal defoliant methods which will enhance agricultural efficiency by improving farmer economic outcomes as well as sustain ecological practice.

## 2. Materials and Methods

Field experiments were conducted on medium-fiber cotton variety S-8286 in the Samarkand region, in the conditions of medium loamy soils with a groundwater depth of 7-8 meters. The experiment consisted of 12 variants, arranged in one layer in 3 rotations, with two irrigation regimes and two fertilization rates. The experimental variants were conducted in a field with a row spacing of 60 cm. All field experiments were conducted based on the "Methods of conducting field experiments" (2007), "Methodical instructions for the State testing of cotton defoliant" (1995), "Methods for determining the properties of cotton fiber" (1972), and GOST 3274.0-72, GOST 3274.5-72, GOST 2182.0-76. Statistical analysis of the data was carried out based on manuals such as B.A. Dospikhov's "Methodology of field experiments" (1979).

## 3. Results

As a result of scientific research conducted in the experimental field and the data obtained, it was found that in the variants where the local UzDEF defoliant was used at a rate of 8.0 l/ha, the yield was 34.9 t/ha with a water regime of 65-65-60 percent and N-250; P2O5-175; K2O-125 k/ha, compared to the ChDNS, while the yield was 38.6 t/ha with a water regime of 70-70-60 percent and N-250; P2O5-175; K2O-125 k/ha.

### Economic indicators of the experiment (per 1 ha)

**Table 1**

	Indicators	Unit of measure	65-65-60 % in irrigation mode	70-70-60 % in irrigation mode
1.	UzDEF	l/ga	8,0	8,0
2.	Productivity	ts/ga	34,9	38,6
3.	Total soum income	m. soum	15781,8	17454,9
4.	Total expenses	m. soum	11769,0	12566,3
5.	Of which; labor costs	m. soum	5052,2	5585,6
6.	Seeds	m. soum	817,5	817,5
7.	Mineral fertilizers	m. soum	1850,0	1850,0
8.	Fuels and lubricants	m. soum	1682,0	1695,0
9.	Other expenses	m. soum	2367,3	2618,2
10.	Profit	m. soum	4012,8	4888,6
11.	Profitability level	%	34,1	38,9

The costs per hectare of land amounted to 11,769.0 thousand soums, which is 65-65-60 percent, with a cash income from the sale of products of 15,781.8 thousand soums, a profit of 4,012.8 thousand soums, and a profitability rate of 34.1%. In the 70-70-60 percent water regime, the costs amounted to 12,566.3 thousand soums, with a cash income from the sale of products of 17,454.9 thousand soums, a profit of 4,888.6 thousand soums, and a profitability rate of 38.9%. Based on this information, it was decided to apply the local UzDEF defoliant, which is inexpensive, at a rate of 8.0 l/ha per hectare, and mineral fertilizers N-250; P<sub>2</sub>O<sub>5</sub>-175; When K<sub>2</sub>O-125 kg/ha was applied, it was observed that the economic efficiency was high and the profitability level was high.

Experimental field trials conducted on S-8286 cotton variety within the Samarkand region demonstrated essential findings about the yield optimization and economic returns influenced by defoliant applications together with irrigation systems and fertilizer usage amounts. The research showed that the highest field yield of 38.6 t/ha occurred when UzDEF defoliant was applied at 8.0 l/ha and the irrigation system used 70-70-60% moisture. This yield exceeded 34.9 t/ha from irrigation with 65-65-60% moisture. The effectiveness of defoliation treatments improves when pre-harvest soil moisture levels are higher because it leads plants to better absorb nutrients and generate more biomass.

The observations demonstrated that fertilizers acted as an essential factor that increased defoliant effectiveness. Defoliating plants with a fertilizer mix of N-250, P<sub>2</sub>O<sub>5</sub>-175, K<sub>2</sub>O-125 kg/ha produced an additional yield benefit of 5.9 centner per hectare compared to lower levels of N-100, P-100, K<sub>2</sub>O-100 kg/ha. Statistical tests showed that higher soil water levels produced definite output improvements ( $p < 0.05$ ) across various irrigation systems proving that adequate water increases the effectiveness of defoliants.

#### Economic Analysis:

Higher irrigation levels in combination with UzDEF resulted in greater profitability with 4,888.6 thousand soums/ha of net income and 38.9% profitability level. The effective

defoliation treatment resulted in reduced labor expenses because defoliation proved more successful in those areas.

The early implementation of defoliation through UzDEF proved to be beneficial because it streamlined mechanized cotton harvesting operations while simultaneously boosting cotton product quality. Future research needs to investigate UzDEF's persistent effects on soil fertility as well as fiber characteristics together with environmental assessments using various soil conditions.

#### 4. Discussion

This research delivers essential knowledge regarding defoliant utilization as a method to maximize cotton cultivation success under Samarkand region's meadow-gray soils. Research findings show that aplikasi UzDEF at 8.0 l/ha resulted in maximum yield benefits under the 70-70-60% watering program reaching 38.6 t/ha while the 65-65-60% treatment reached 34.9 t/ha. Plants achieve better health outcomes with improved productivity when soil water content increases because defoliation and nutrient absorption become more effective.

The connection between soil defoliant exposure and mineral nutrient use must be studied in depth for this investigation. The combination of N-250 and P<sub>2</sub>O<sub>5</sub>-175 and K<sub>2</sub>O-125 kg/ha as fertilizers produced maximum yield improvements through optimal nutritional support for defoliation processes. Data from previous studies confirms that adequate nutrients lead to quick leaf death which shortens defoliation time thus preventing vegetation interference with mechanical harvesting operations.

The profitability assessment demonstrates that UzDEF develops commercial potential through improved irrigation methods and nutrient supply. The profitability rate rose from 34.1% (lower irrigation) to 38.9% (higher irrigation) due to optimal simultaneous irrigation and defoliant application. The enhanced defoliation supported by the study helps lower manual labor expenses while building economic potential that encourages big-scale automated cotton harvesting.

The timing of defoliation procedures substantially affects cotton fiber quality that directly correlates to success of machine-based harvesting systems. The cotton plants which received defoliation treatment at an early stage dropped their leaves in a uniform manner thereby reducing the contamination found in the harvested cotton. The market value and price levels of cotton products heavily depend on the fiber purity which makes this discovery essential for producers. Future research must evaluate both micronaire values and fiber strength to provide quantitative evidence about these findings.

Apart from the successful outcomes researchers encountered specific obstacles during the research process. The investigation took place exclusively within the meadow-gray loam soil type which restricts its application outside of this particular area. Research should investigate how defoliant applications impact long-term soil microbial communities along with evaluating the accumulation of chemical residues because these environmental aspects need additional assessment.

The research findings establish UzDEF as a locally produced defoliant which boosts cotton productivity as well as economic returns by using appropriate irrigation and fertilization methods. The study provides essential data for sustainable cotton farming approaches by replacing foreign defoliants with UzDEF and improving agricultural machine harvesting effectiveness. Additional studies focusing on seasonal modifications and adaptive water management techniques and integrated pest control practices would enhance the recommendations for cotton defoliant usage throughout Uzbekistan's cotton industry.

#### 5. Conclusion

1. In the experiment, the effect of the amount and ratio of fertilizers on cotton yield was as follows according to the options; In the variants with the fertilizer amounts of N-

200 kg, R2O5-140 kg, K2O-100 kg/ha, when the pre-irrigation moisture content of cotton was increased from 65-65-60 percent to 70-70-60 percent compared to ChDNS, it was observed that the cotton yield increased by 5.1-6.2 centners, and it was also calculated that in the variants with the amounts and ratios of fertilizers of N-250 kg, R2O5-175 kg, K2O-125 kg/ha, this indicator was higher by 3.0-5.9 centners/ha.

2. According to the experimental data, the use of soil moisture by plants in the reporting year was 8.9-11.8 percent, runoff water use was 77.0-81.4 percent, and precipitation was 9.6-11.2 percent depending on the irrigation regime. 6. In the experiment, it was noted that for 1 centner of crop, in the irrigation regime of 65-65-60 percent compared to the ChDNS, the average runoff water consumption was 132.9-141.7 m<sup>3</sup>, and the total water consumption was 154.3-180.9 m<sup>3</sup>, while in the irrigation regime of 70-70-60 percent compared to the ChDNS, the average runoff water consumption was 118.8-125.0 m<sup>3</sup> and the total water consumption was 152.7-174.0 m<sup>3</sup>.

3. In the field experiment, it was observed that in the variants where the UzDEF defoliant was applied at a rate of 8.0 l/ha, economic efficiency was achieved, with a high profitability rate of 32.3-39.9 percent.

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