



## The Defeat of Cotton with Wilt in the Conditions of Uzbekistan

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**Annotation:** As a result of a survey of cotton fields in various regions of the republic, it was found that in all the cotton fields surveyed in the republic, commercial varieties of cotton are infected with wilt disease to one degree or another. The most tolerant to wilt pathogens was the variety C-8290 in the conditions of the Fergana region. The harmfulness of the disease on the weight of seeds and cotton fiber was noted.

**Keywords:** Soil, cotton, variety, wilt, pathogen, fungus, resistance, disease, wilting, cotton.

**Introduction.** Wilt, that is, withering of cotton, is found in all cotton-growing countries of the world.

Research has long been carried out on the identification and study of cotton diseases in Uzbekistan (A. A. Yachevsky (1929; 1931), N. G. Zaprometov (1926; 1929), A. I. Solovyova, A. V. Poyarkov (1940), N. S. Mirpulatova (1973), I. S. Urunov (1988), A. Kh. Khakimov (1989), A. Marupov (1975; 2003; 2013; 2022; 2023), etc.

Cotton wilt disease in Uzbekistan occurred during the former Soviet Union, as a result of long-term cotton monoculture, non-use of special crops against wilting, non-removal of cotton stalks from the field with roots, excess wilting infection in the soil, and chronic planting of one variety in the same area in for many years and so on are widespread in all regions.

According to K. Baker (1968) and N. S. Mirpulatova (1973), on one plant affected by wilt, there are more than 240 thousand microsclerotia of the pathogen.

For these reasons, wilt disease caused great economic damage to the cotton growing of the republic in the 60-70s of the last century.

In recent years, especially in Bukhara and its neighboring regions, cotton varieties are severely affected by Fusarium wilt caused by *Fusarium verticilloides*, when 2-4 true leaves are formed on them. This fungus has not previously been reported in the literature as causing cotton wilt. In Bukhara and Navoi regions, in areas heavily affected by Fusarium wilt, 50.0% or more of plants die.

On May 25, 2021, the President of the Republic of Uzbekistan Shavkat Mirziyoyev, at a meeting on measures to improve the plant protection system, focused on the damage caused by wilt disease in the Bukhara region and gave instructions on developing measures to reduce its harmfulness.

Basically, cotton is severely damaged by gommosis, root rot and wilting, that is, wilt disease. In most cases, the affected plants die, and the thickness of the seedlings decreases. The quality of the fiber and seeds of diseased plants deteriorates, causing great economic damage.

There is a chemical fight against gommosis and root rot, but there are no radical measures to combat wilting.

Fungi that cause cotton wilt are present in all regions of the republic and damage the plant to varying degrees.

According to V.V.Filipov and others (1976), fungi belonging to the genus *Verticillium* infect more than 660 plants, and according to S.F. Sidorova (1983), fungi belonging to the genus *Fusarium* infect about 1000 cultivated and wild plants.

How sick a plant is depends on the amount of the pathogen in the soil, virulence, variety resistance, agricultural technology and other factors.

In the conditions of Uzbekistan, cotton varieties *Gossypium hirsutum* L. and *Gossypium barbadense* L. are currently cultivated, and infected with fungi by three pathogens of wilt disease - *Verticillium dahliae* Klebahn, *Fusarium oxysporum* f. sp. *vasinfectum* (Atk.) Snyderet. Hansen and *Fusarium verticillioides* (Sacc.) Nirenberg (Syn.: *Fusarium moniliforme* Sheld.), (Marupov et al., 2013).

In areas where all cotton varieties of the republic are grown, the soil is affected by a small or large amount of wilt fungus, and it is necessary to determine the damage caused by the disease to the crop and create control measures by studying the bioecology of the pathogenic fungus.

Therefore, the actual issue is to determine the area of distribution of the wilt disease in all regions of the republic, under various soil and climatic conditions, the appropriate placement of varieties and the development of effective control measures.

**Place and methods of research.** The level of cotton damage by wilting was determined according to the method of the All-Union Research Institute of Cotton (UnionCRI, 1981) in the areas of cotton planting in Bukhara, Navoi, Andijan, Namangan, Ferghana, Tashkent, Syrdarya, Jizzakh, Kashkadarya and Surkhandarya regions. Samples of infected plants were taken and pathogenic fungi were grown in laboratory conditions on pure and artificial media "Chapek" and potato agar M.K. Khokhryakov (1969) and extracted them according to the method of S.F. Sidorova (1983). The species composition of the isolated wilt fungus was determined using the determinants of N.M. Pidplichko (1977) and V.I. Bilay (1977).

Damage to 1000 seeds and pod fiber mass was determined based on conventional breeding methods.

**Research results.** In order to monitor the level of damage by wilting of regional varieties of cotton, targeted observations were carried out in the fields of Andijan, Fergana, Namangan, Tashkent, Syrdarya, Jizzakh, Bukhara, Navoi, Kashkadarya and Surkhandarya regions.

It is known that the effectiveness of measures against each harmful organism, the timeliness of their forecasting, the degree of infection of cultivars and their resistance to diseases, the virulence and aggressiveness of pathogenic fungi are inextricably linked.

Depending on the stage (phase) of cotton development in the areas of the Ferghana Valley, the level of damage to plants by wilting and pathogens was analyzed. According to the results obtained (May 28), with the formation of 2-4 true leaves of cotton in the Uychi district of the Namangan region and in the "Shamsutdin Khodji" farms of the Namangan region, the wilting disease in the Andijan-37 variety was at the highest level and amounted to 20 and 30%. The wilt fungus *F. verticilloides* was isolated from infected plants.

In the farms of "Sadokat Ramz" of the Markhamat district of the Andijan region, the cotton variety Andijan-37 showed no signs of withering disease. In the fields of "Markhamat Agro Cluster" the incidence of this variety was 1.0%.

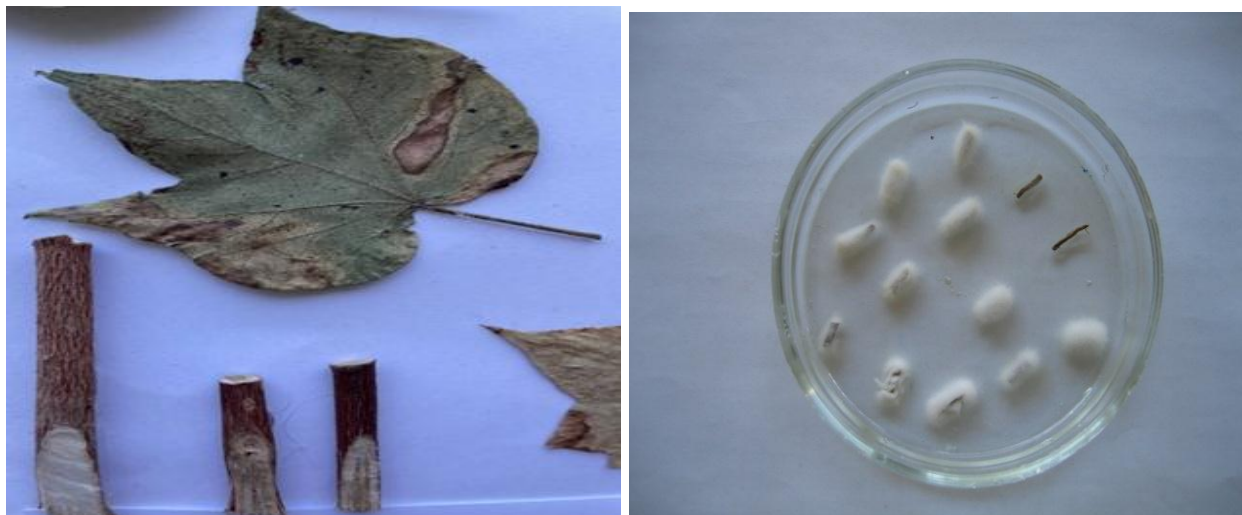
In variety C-8290 in the Baghdad and Kuva districts of the Fergana region, no signs of the disease were detected. On the fields of the farm "Musavvir Tex Cluster" of the Dangara region, 2.0% infection with wilting of the C-8290 variety was noted.

The fungus *F. oxysporum* was isolated from infected plant samples. At the stage of tillering and flowering of cotton (June 28) in the farm "Omad 2000" of the Chust district of Namangan region, the

incidence of wilting of the Andijan-35 variety was 1.0%, the fungus *F. oxysporum* was isolated from infected plant samples. This indicator was 15.0% for the Namangan-34 variety on the Nozanin farm, and the fungus *F. verticillioides* was isolated from infected plant samples.



**Figure 1. Infected plants Figure 2. Field affected by wilting**



**Figure 3. Leaf and stem of an infected plant. Figure 4. Pathogen isolated from infected plant. a strip of leaves.**

There were no signs of wilt disease in cotton varieties grown on the farms "Shagidon Burgut Diyor" of the Torakurgan region and "Alisher Zamin" of the Pop region.

The main reasons for the absence of symptoms of the disease at this stage of plant development are the fact that the soil is not watered, and the high temperature creates unfavorable conditions for the vital activity of pathogens in the soil.

The Andijan-35 variety, planted on the Nakhotka farm in the Altinkul district of the Andijan region, had a morbidity rate of 1.0%. *F. oxysporum*, the causative agent of wilt, was isolated from infected plant samples in a clean environment.

In the Baghdad district of the Fergana region, the incidence of the C-8290 variety was 1.0 and 3.0% in the fields sown with cotton by the branch of the institute and Musavvir Tex Cluster of the Dangara region, the pathogen *F. oxysporum* was isolated. from infected plants in Chapek clean artificial environment. On the fields of the farm "Khamza Export" of the Altyaryk district, the variety C-8290 showed no signs of the disease withering.

During the period of cotton ripening (August), the number of plants affected by wilting of variety C-8290 in the cotton fields of "Musavvir Tex Cluster" was 4.0%, and in the fields of the institute's branch in Baghdad district - 2.0%.

In the farm "Turdiali" of the Kuva district, the incidence of the C-8290 variety was 0.5%, and in the farm "Marufjon" of the Altiaryk district and on the fields of the farm "Abror" of the Tashlak district, no signs of the disease were found in this variety.

The pathogen *F. oxysporum* was isolated from infected plant samples.

In conclusion, it should be noted that the fungus *V. dahliae*, the causative agent of verticillium wilt disease, was not isolated from plant samples infected with wilt in the cotton fields of the Ferghana Valley regions.

It is possible that the activity of the fungus *V. dahliae* in the soil was negatively affected by changes in global climatic conditions and crop varieties, as well as the influence of mineral fertilizers and agricultural technologies used in recent years.

S. F. Sidorova (1983) noted that the fungus *V. dahliae* is less competitive in the soil than fungi belonging to the genus *Fusarium*.

It is possible that the number of *Fusarium* propagules in the soil increased, while the soil microflora and the fungus *V. dahliae* decreased due to other anthropogenic influences.

Table 1 presents the results of studies conducted in Bukhara, Navoi, Kashkadarya, Surkhandarya, Tashkent, Syrdarya and Jizzakh regions to analyze the degree of damage to cotton by wilting and pathogens.

During the period of cotton maturation (August - September), varieties Bukhara - 6 and Bukhara - 102 were infected with wilt to the greatest extent (50.0-62.5%) in Bukhara, Navoi and Kashkadarya regions. This indicator was 12.5% for the Bukhara-102 variety and 37.5% for the Sultan variety in the Surkhandarya region.

In the S-8290 variety in the Chinaz district of the Tashkent region, wilt disease was observed in 3.0% of plants, and in the AN-Boyout 2 variety in the Mirzaabad district of the Syrdarya region, this figure was 1.0%.

The fungus *F. verticillioides* in most cases was isolated from samples of plants infected with wilt, brought from all these regions. Only in the cotton fields of the "Angor Cluster Surkhan Gururi" in the Angor district of the Surkhandarya region, the fungus *F. oxysporum* was isolated in a clean environment, causing the wilting of the Bukhara-102 variety.

The fungus *V. dahliae*, the causative agent of verticillium wilt, was isolated from the cotton variety AN- Boyout 2, planted in the fields of the Mirzaabad district of the Syrdarya region.

In conclusion, it should be noted that in all regions listed in Table 1, *Fusarium* wilt is caused mainly by fungi belonging to the genus *Fusarium*. This case shows that in the soil conditions of the cotton-growing areas of the Republic, *Fusarium* fungi predominate over *Verticillium* fungi.

Data on the effect of wilt disease on the average weight of seeds and fiber in 1 cotton boll in the seed fields of the Fergana Valley, Kashkadarya and Surkhandarya regions are presented in Table 5.

**Table 1 Cotton wilting rate and pathogen analysis August-September 2022**

№	Sampling location	Variety	Field, ha	wilt infection, %	Isolated pathogens		
					V.d	F.o.v	F.v
1.	In the farm of Achil Kudrat Zamin, Zhondor district, Bukhara region.	Bukhara - 6	7,6	50,0	-	-	+
2.	In the farm of Uktam Zokirovich Alisherov, Zhondor district, Bukhara region.	Bukhara - 6	7,0	25,0	-	-	+
3.	Kyzyltepa district of Navoi region	Bukhara - 10	8,0	55,0	-	-	+

4.	In the farm of "Sukhrob" in Mekhnatabad mahalla, Chirakchi district, Kashkadarya region	Bukhara - 102	9,0	62,5	-	-	+
5.	In the farm of Ashurov Bobosher Urozevich, Mekhnatabad district, Chirakchi district, Kashkadarya region	Bukhara - 102	12	50,0	-	-	+
6.	As part of the "Karshi agrocluster" of the Beshkent MTP of the Karshi district of the Kashkadarya region	Bukhara - 102	14,0	0,0	-	-	-
7.	In the farm of Khudoyberdiev Komil, Beshkent MTP, Karshi district, Kashkadarya region	Porlok	12,0	12,5	-	-	-
8.	In the farm "Angora Cluster Surkhan Gururi", Angorsky district of Surkhandarya region	Bukhara - 102	7,6	12,5	-	+	-
9.	In the farm Mamatkul, Muzrobot district, Surkhandarya region	Bukhara - 102	15,0	0,0	-	-	-
10.	In the farm AMIRKUL BOBO KAA, Muzrobot district, Surkhandarya region	Bukhara - 102	53,0	0,0	-	-	-
11.	In the farm of Kulpista, Saryasiya district, Surkhandarya region	Sultan	20,4	37,5	-	-	+
12.	Chinaz district of Tashkent region	C-8290	4,7	3,0	-	-	+
13.	Mirzaabad district of Syrdarya region	AH-BoëyT-2	3,7	1,0	+	-	-
14.	Dustlik district of Jizzakh region	C-8290	5,0	0,0	-	-	-

According to Table 2, the weight of 1000 seeds of Sultan variety cotton in bolls collected from a healthy plant was 110.3 g, and the weight of seeds from bolls collected from a diseased plant at the Kulpista farm in the Saryasiya district of the Surkhandarya region was 100.8 g. Damage by Wilt's disease is defined in 5 gr. In a healthy plant, the average fiber weight of 1 pod is 6.41 g, in a diseased plant it is 5.71 g, and the fiber mass lost due to wilting is 0.7 g.

The weight of the seed in healthy pods of the Bukhara-102 variety was 110.7 g, and the weight of the pods of a diseased plant was 100.9 g in the Sukhrob farm, Mekhnatabad district, Chirakchi district, Kashkadarya region. Wilting disease damage was 8 g. The average fiber weight of 1 pod collected from a healthy plant is 5.98 g, the weight of a diseased plant is 4.55 g, and the weight of fiber lost due to wilting is 1.43 g.

The weight of 1000 seeds collected from healthy pods of the Andijan variety - 35 from the fields of the Khodjimetov farm in the Torakurgan district of Namangan region was 120.7 grams, the weight of seeds collected from diseased plants was 95.96 grams, and the wilt disease affected was 24.74 grams. In this area, the average weight of fiber in 1 pod of a healthy plant was 5.9 g, a diseased plant was 5.5 g, and the weight of fiber lost due to wilting was 0.5 g.

In the Balykchi district of the Andijan region, for 1000 healthy seeds of the Andijan-35 variety, there were 124.26 g of healthy seeds, 101.5 g of diseased seeds and 22.76 g of diseased seeds. In a healthy plant, the average fiber weight per pod was 6.0 g, in a diseased plant it was 5.61 g, and the weight of fiber lost due to wilting was 0.39 g.

In the Fergana region, the weight of 1000 seeds collected from healthy cotton plants of the S-8290 variety was 118.6-126.0 g, and the weight of seeds collected from infected plants was 97.78-114.14 g.

**Table 2 Effect of wilting on cotton seed and fiber mass, 2022**

№	Sampling location	Cotton variety	Weight of 1000 seeds, gr			Weight of fiber in 1 pod, gr		
			healthy	infected	harm from wilt	healthy	infected	harm from wilt
1.	In the farm of Kulpista, Saryasiya district, Surkhandarya region	Sultan	110,3	100,8	5,0	6,41	5,71	0,7
2.	In the farm of "Sukhrob" in Mekhnatabad mahalla, Chirakchi district, Kashkadarya region	Bukhara - 102	110,7	100,9	8,0	5,98	4,55	1,43
3.	In the farm "Khojimetov" of the Torakurgan district of the Namangan region	Andijan - 35	120,7	95,96	24.74	5,9	5,5	0,5
4.	Balykchi district of Andijan region	Andijan - 35	124,26	101.5	22.76	6,0	5,61	0,39
5.	In the farm "Turdiali" of the Kuva district of the Fergana region	C-8290	126,0	114,14	11.86	6,0	5,9	0,1
6.	Kuva district of the Fergana region	C-8290	122,1	100,41	21.69	6,0	5,0	1,0
7.	In the farm "Cluster Musavvir Teks", Dangara district of the Fergana region	C-8290	118,6	97,78	20,82	6,0	5,4	0,6

The weight loss of 1000 seeds from wilting was 11.86 - 21.69 g.

In a healthy plant, the average fiber weight per pod was 6.0 g, in a diseased plant it was 5.4 g, and the weight of fiber lost due to wilting was 0.6 g.

**Conclusion.** Thus, it was found that the wilt disease affects cultivars in all observed regions of the republic. The disease has been found to significantly reduce seed and fiber mass.

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