History and development prospects of silk farming in Uzbekistan

Bakhtiyar Nasirillaev[1*], *Narzulla* Rajabov[2], *Murodkhuja* Abdukadirov[3], and *Khurshida* Fozilova[2]

[1]Research Institute of Silk Production, 2, Ipakchi str., 100024 Tashkent, Uzbekistan
[2]Tashkent State Agrarian University, 2, University str., 100140 Tashkent province, Uzbekistan
[3]Chirchik State Pedagogical Institute, 104, Amir Temur str., 110055 Chirchik, Uzbekistan

Abstract. Mulberry silkworm seeds were smuggled to Central Asia by a Chinese princess married to Khotan Khan in the middle of the 4th century. By the 7th century, Khotan, Kusham and other Northern Silk Industry was the main labor activity of the population in the provinces of Turkestan. In the 7th century, as a result of the introduction of the technology of cocooning and gazlam weaving by Marv merchants for commercial purposes from Persia, it became more widespread in the territory of Central Asia. Uzbekistan is a country with a long history among the world's developed silk industry. Mulberry silkworm seeds entered Central Asia through the Khotan province in the middle of the 4th century, and have become one of the main occupations of the population until now. This article analyzes the history of sericulture in Uzbekistan, stages of development, and achievements in the field of research and production. It is planned to increase the total area of mulberry plantations in Uzbekistan from 48,720 hectares in 2019 to 77,422 hectares by 2021, and the number of individual mulberry rows to 79 million 515 thousand bushes. It is also planned to increase the number of boxes of silkworms from 350,000 boxes to 500,000 boxes, from 19,607 tons to 30,000 tons. Keywords: Sericulture, silk cocoon, silkworm seed, silk cloth, raw silk, mulberry tree.

1 Introduction

Today, 22-24 million boxes of super-elite, elite and industrial eggs of the mulberry silkworm are produced in more than 20 countries with developed sericulture industry around the world, and 80.1% of the produced silkworm eggs are in the People's Republic of China, 1.3% in Uzbekistan and 6.0% corresponds to the share of other countries. The People's Republic of China, which is considered a leader in the field of silk production, produces 200.7 thousand boxes, 32.6 thousand boxes in India, 7-8 thousand boxes in Uzbekistan, and other countries prepare super-elite and elite mulberry silkworm eggs for their needs. More than 850,000-860,000 tons of cocoon raw materials are produced in countries with developed sericulture, and the cocoon yield from one box is 85.0 kg in the PRC, 80.0 kg in India, and 57.0-59.0 kg in Uzbekistan [1-7].

* Corresponding author: b.nasirillaev@umail.uz

The history of silk production goes back a long way. Silk making first appeared in China; some sources mention the art of cocoon spinning in 2697 BC during the reign of the Chinese emperor Siling-Chi. Domestic sericulture dates back to 3000 BC, when Emperor Shi-Nong issued an edict on planting mulberry trees and raising silkworms. It follows from this that it has been at least 3000 years since the emergence of sericulture as a separate industry, and it can be accepted that the cultivation of the mulberry silkworm has been over 5000 years [8-12].

As the motherland of silk production, it is mentioned in the sources that Shan-Dong province of China paid tribute to the emperor from 2255 BC with silk fiber and gauze [13-17].

The main reason why the Chinese government has become a major hegemon in the field of sericulture in the world is that the secrets of sericulture have been kept secret from foreigners for many years, and the death penalty has been imposed on those who reveal this secret. However, this process did not last long; In 200 BC, it spread to Korea and then to Japan, and in the 5th century it spread to the whole world.

In the countries of India and Persia, not only imported from China, but also local breeds of yellow cocoons were created [18-25].

Mulberry silkworm seeds were smuggled to Central Asia by a Chinese princess married to Khotan Khan in the middle of the 4th century. By the 7th century, Khotan, Kusham and other Northern Silk Industry was the main labor activity of the population in the provinces of Turkestan [26-28]. In the 7th century, as a result of the introduction of the technology of cocooning and gazlam weaving by Marv merchants for commercial purposes from Persia, it became more widespread in the territory of Central Asia. However, wars, famine and many other factors hindered the development of silk production, and at the end of the 18th century, it was preserved only in Marv [29, 30]. In 1785, Bukhara khan Shamurod-beg captured Marv and took people related to silk production as prisoners like others. In this way, silk production and cocoon spinning spread from Persia to Bukhara, and from Bukhara to Samarkand and Tashkent provinces [31, 32]. It entered Kokan and Khojakent provinces from China Turkestan.

2 Materials and Methods

According to Petrovsky [7], in 1874, Bukhara and Khiva khanates were clearly highlighted as the provinces where the development of Central Asian sericulture was accelerated. In the provinces of Tashkent, Shymkent and Turkestan, a small number of people were engaged in silk production.

After the 1870s, there was a decline in Central Asian sericulture due to the outbreak of diseases, especially pebrina disease. As a result, the problem of providing the population with healthy seeds was partially solved by the first seed production enterprise opened in Turkestan in 1886, with a capacity of 5,000 misqal (1 misqal = 4.26 g). By 1896, the demand for quality mulberry silkworm seed was almost met by producing 460,000 bushels of seed. By the end of the 1890s, more than 90 large seed production enterprises were opened, including Samarkand, Fergana and Kokan seed production enterprises. As a result of the strict measures taken, in 1896 a harvest of 130,000 poods (1 pood=16.3 kg) of cocoons was obtained throughout Turkestan.

Before the war, in 1913, more than 150,000 farms engaged in sericulture produced 350,000-400,000 pounds of cocoons, 80% of which fell on the territory of Fergana.

3 Results and Discussion

As a result of the wrong agrarian policy conducted since 1910, the revived seeds decreased from 300,000 boxes to 11,615 boxes by 1919. In 1922, the government established the joint-stock company "Turkshyolk" in order to develop the lagging cocoon industry. In order to support the development and support of local cocooning, this institution created on the basis of protectionism imposed high duties on imported raw materials and established a monopoly in this field. The proximity of worm seed factories to cocoon growing areas has become one of the important factors in the development of sericulture in Turkestan and especially in Uzbekistan.

In 1918, by the government's decision, the Ferghana cocooning factory was built and started its operation in 1920. In 1924, Uzbekistan exported 10,000 boxes of seeds to Kashgar. By this time, within Uzbekistan of Turkestan, 5.8% of silkworm seeds were sold to worm breeders, while the private sector accounted for only 12.8% of silkworm sales. In 1926, during the land-water reform, private production of worm seed was prohibited by law in Uzbekistan.

In 1924, "Turkshyolk" managed to organize a two-year course at the Central Asian Silk Plant for the purpose of training specialist personnel. M. Poshshahojaev, the author of the first manual in the Uzbek language in the field of silk production, was appointed as the leader of this course. In this course, professors E.F. Poyarkov, A.I. Fedorov, M.I. Slonim, K.D. Platov, A.A. Küntsel and other scientists and industry representatives worked as the first teachers.

Also, in 1925, three-month courses for training instructors in worm rearing were opened at the sericulture stations in Tashkent and Fergana.

In order to further develop sericulture on a scientific basis, in 1927, according to the government's decision, the Central Asian Institute of Sericulture and Silk Science, and later, the Central Asian Scientific Research Institute of Sericulture (SANIISh), was established on the basis of the Central Asian Silkmaking Station and the Turkshyolk base. The Tashkent seed factory and the Jarariq nursery were attached to this institution as subsidiary enterprises of the institute.

In the early 1930s, an effort to renew silkworm hybrids was made by replacing the low-silk Baghdad breed with hybrids obtained from cross-breeding with Askoli, Oro, and other breeds. In 1937, the share of production of large industrial products in silk industry by newly built or completely reconstructed enterprises reached almost 98.0%. As a result of such rapid development of production, the demand for raw materials also increased. In 1938, 11,913.7 tons of cocoons were harvested for the first time in the history of sericulture of Uzbekistan. By 1940, up to 60.0 kilograms of cocoons were harvested from each box, and 10,000 tons of cocoons were harvested across the country. During these years, more than 12.5 million bushes of high-quality and nutritious mulberry leaves were planted. 7200 hectares of plantations were established.

Since 1949, as a result of the use of a new method of intensive feeding of silkworms, the yield of cocoons has exceeded 103 kg per box of seeds. In 1952, the yield of cocoons from each box of worm seed reached 118.7 kg, and the quality improved further. The amount of fertile cocoons increased from 83.0% to 93.0%. The worm feeding season ended in 21-22 days. Based on this, by 1953, selection work on the new breeds SANIIsh-E-I and SANIIsh-E-II with high silk yield was completed, and they were involved in the trial process in order to put them into practice.

In 1959, Uzbekistan for the first time ranked 3rd in terms of productivity in the field of sericulture after Japan and China, the leading countries in the world. According to the accounting books, Uzbekistan produced twice as much as Iran, Turkey, Brazil, France, Greece, Spain, and Lebanon.

In 1960, the progressive method of hybrid breeding was developed in Uzbekistan for the first time in the history of world sericulture. This was based on the principle of selection based on male-female breeds, and thanks to such inheritance, it was possible to obtain hybrids with valuable morphological and economic indicators. As a result of this, in 1962, productivity in Uzbekistan increased, and the cocoon obtained from each box of worm seeds increased from 46.5 kg to 60.2 kg.

Fergana breeding station was completed in 1963. After the Fergana breeding station came into operation, all the breeding shops of the worm seed factories in the Fergana Valley and Urganch were closed. This made it possible to breed worm seed for industry in other factories.

In connection with the transition to the white cocoon hybrid, the silkiness of dry cocoons in Uzbekistan increased from 27.2% in 1950 to 31% in 1964. As the silk industry switched to automatic cocooning and the demand for the quality of cocoon fiber increased, there was a need to replace existing hybrids with new hybrids that meet the modern demands of the industry for cocoon raw materials. In this regard, starting from 1960, at the Central Asian Research Institute of Sericulture, under the leadership of Academician V.A. Strunnikov, complex genetic schemes were developed for creating breeds with a balance in terms of embryonic lethality, allowing sexing at the worm and seed stage, and with the participation of these breeds, male-sex hybrid combinations were obtained, which were superior in many aspects compared to double-sex hybrids.

Since 1964, zoning of Tetraduragay-3 and Tetraduragay-4 industrial hybrids has started in Uzbekistan. Their importance in the cultivation of silkworm seeds has increased. The advantages of complex hybrids were evident both in the breeding of worm seed and in its industrial reproduction. By 1965, more than 17,850 tons of cocoons were collected on the scale of Uzbekistan, and in 1968, more than 19,000 tons of cocoons were put into practice.

In 1973, 80.0% of raw materials were processed in conveyor units according to the new technology. Accordingly, complex mechanization of cocoon processing, drying, and storage was necessary within a few years. Due to the introduction of new high-yielding breeds and hybrids of silkworm seeds, improved agrotechnics of worm feeding, increased quality of worm seeds, and the emergence of worms from this seed in two to three days, the period of cocoon preparation has been drastically reduced. By 1975, 27,137.2 tons of cocoons were grown in Uzbekistan.

In 1977, all worm seed enterprises of Uzbekistan produced 593,000 boxes of quality and healthy worm seed for the 1978 harvest. This year, the 50th anniversary of the Central Asian Research Institute of Sericulture was celebrated. During this half century, 52 breeds and hybrids of silkworm, 70 varieties of mulberry were created, 32 varieties of silkworm and 14 varieties of mulberry were put into practice.

By 1980, the highest rate of cocoons produced in Uzbekistan up to that time was recorded - 30,300 tons. This year, cocoon quality, fertile cocoon and average yield per box of worm seed was 73.4 kg.

The decline in the silk industry in the period before independence - 1991 is explained by the disintegration of the former USSR state and the resulting problems in the industry. After the Republic of Uzbekistan gained independence in 1991, it prepared 150,010 boxes of seeds and exported 11,632 boxes of seeds to neighboring Kazakhstan, while the share of mulberry silkworm seeds imported by Tajikistan reached 20%.

In 1998, the "Uzbek silk" association was founded by the decision of the Cabinet of Ministers for the revival and development of the agricultural sector, including the silk sector, and all the silk sector was united into a new structure.

By the decree of the President of Uzbekistan on November 15, 2006, the task was set to increase raw silk production to 50% by 2011. That is, 1,515 tons, of which 1,000 tons will be of type 2A and 3A. In order to ensure the implementation of the order, a number of

measures have been taken to revise the feed base necessary for sericulture, increase the number of mulberry trees and expand the area of mulberry plantations. According to 2008 data, the number of mulberry trees is 6 million, and the area of mulberry plantations has increased by 4,000 hectares.

By 2010, it became the leading country in the field of silk production in Central Asia. Due to the activity of 3 selection points and 14 enterprises producing seeds of silkworm hybrids, using more than 20 high-quality local productive breeds, the Republic has the potential to grow more than 400,000 boxes of seeds per year.

In 2012, 450,000 boxes of seeds worth about 2.454 million US dollars were produced. This means more than 80,000 boxes of seeds prepared in the last 5 years. As a result, the seed imported from the PRC decreased to 30%, and local hybrids took its place.

Due to the correct economic policy carried out in Uzbekistan, it has become one of the 5 leading cocoon-growing countries in the world. The fact that 85% of the cocoon crop grown in Central Asia belongs to Uzbekistan is evidence of the great contribution of 18 cocoon processing, 7 cocoon spinning and 5 textile enterprises.

By 2012, Uzbekistan established strong international relations with countries such as the PRC, South Korea, and Japan, which are world leaders in cocooning. Enterprises such as "Murukabi" and "Kanebo", launched in cooperation with Japan, are receiving 150 tons of high-quality products due to the investment worth 18 million US dollars. Also, the Uzbek-Chinese joint venture "InterSilkPro" has the capacity to produce more than 2,000 tons of raw silk per year due to the provision of the latest equipment. This allowed countries such as Italy, Switzerland, Japan, China, India, and Singapore to earn more than 8 million US dollars due to the export of competitive products.

In the period of independence, more than 20 promising varieties of mulberry were created by breeding scientists, and 9 varieties were included in the State Register of agricultural crops recommended for planting in the territory of Uzbekistan, among them Uzbeksky, Holodnostepskaya 6, Zimostoykiy, Mankentsky, Oktyabrsky, Pionersky, SANIIsh 33, Surkh- mulberry, Tadjikskaya bessemyannaya varieties, in addition to this, high-productivity Topcross-2, Topcross-3 and Uzbek hybrids of mulberry have been created by targeted hybridization, which are now provincealized in the provinces of Uzbekistan.

During the years when Uzbekistan gained independence, using analytical and synthetic methods of selection, polyploidy and radiomutagenesis, the productivity of mulberry was high. 34 varieties were created and submitted to the State Commission for Testing Agricultural Crops to conduct State trials.

Jarariq-7, Jarariq-8 varieties on the basis of decision No. 215 of the State Commission for Testing Agricultural Crops of Uzbekistan in 2011; In 2012, on the basis of decision No. 228, mulberry varieties SANIIsh 34, Jarariq 2, Jarariq 4 and Jarariq 5 were included in the State Register of agricultural crops recommended for planting by the State Commission for Testing Agricultural Crops Varieties of Uzbekistan. Jarariq 11 and Jarariq 12 mulberry varieties were submitted to state tests in 2013.

In 2012, mulberry varieties Jarariq 7 and Jarariq 8, in 2013 Jarariq 2, Jarariq 4, Jarariq 5 and SANIIsh 34 varieties, and in 2014 Jarariq 9 and Jarariq 10 varieties were obtained.

18 industrial hybrids of silkworm, created as a result of scientific research conducted by breeder scientists of the institute during the years of independence of Uzbekistan, were included in the State Register and provincealized. Spring 1, Spring 2, Uzbekistan 5, Uzbekistan 6, Ipakchi 1 × Ipakchi 2, Ipakchi 2 × Ipakchi 1, Turon 1, Turon 2, Golden Valley 1, Golden Valley 2, Navruz 1, Navruz 2, Gulshan × Nafis, Nafis × Gulshan, Navroz 3, Navroz 4, Zarafshan, and Istiqbol hybrids are among them. Currently, newly created industrial hybrids of silkworm Musaffo tola 1 and Musaffo tola 2 are undergoing state tests.

The scientists of the institute created four systems of mulberry silkworms that give thin fiber silk, with their participation, productive hybrids were obtained, the hybrids Navro'z 1

and Navro'z 2 (3200-3400 m/g) in 2013 and Navro'z 3 and Navro'z 4 (3200-3400) m/g) hybrids were included in the State Register in 2017 and recommended for production.

The hybrids of mulberry silkworm AGU-112 × UzNIISh-9 and UzNIISh-9 × AGU-112, created for the summer worm feeding season, were found promising by the State Commission for Testing Varieties of Agricultural Crops of Uzbekistan and entered into the State Register in 2013.

As a result of in-depth genetic research, scientists of the Institute created breeds that were marked for the first time in the world sericulture science by egg color (gray eggs hatch females, white-yellow eggs hatch male worms) and whose genotype embodied the characteristics of a heavy silk shell.

Based on the requirements of the world silk market, as a result of fundamental research, Line 27 and Line 28 systems that yield fine silk fiber (3500-3700 m/g) and the industrial hybrids Mumaffo fiber 1 and Musaffo fiber 2 with their participation were created. These hybrids have significant advantages over existing standard hybrids.

Ipakchi 1 x Ipakchi 2 and Ipakchi 2 x Ipakchi 1 Uzbekistan 5, Uzbekistan 6 hybrids created at the institute make up 55-60 percent of the total industrial hybrids of mulberry silkworms bred in the territory of Uzbekistan. The rest of the total volume is brought from abroad due to necessity.

In order to provide the republican cocoon industry with high-quality breeding and industrial eggs, systems with high reproductive characteristics were created in the maternal breeds of industrial hybrids included in the State Register in order to increase the egg productivity of maternal breeds of butterflies in silkworm breeding stations and seed enterprises. The number of eggs laid by one mother butterfly is 750-800 and more.

The new complex technology of repeated worm feeding has been successfully tested in Fergana, Samarkand and Navoi provinces. According to this technology, it will be possible to feed 150,000 boxes of worms and grow 6.0-7.5 thousand tons of additional cocoons, and provide employment and income to more than 150,000 villagers.

In the field of preliminary processing of cocoons, a number of scientific problems were solved by scientists of the institute and introduced into production. In particular, a modernized energy-saving version of the SK-150K cocoon dryer was created and put into production. In addition, a new method of processing cocoons with solar energy, which is an unconventional energy source, and a device working on this basis was created and put into production.

The institute has developed the following regulatory documents for cocoon products grown in the field:

Interstate standard GOST 31255-2004 “Silkworm cocoons are air-dry carapaces. Technical conditions”;

Interstate standard GOST 31256-2004 “Silkworm cocoons are air-dry. Technical conditions”.

Interstate standard GOST 31257-2004 “Silkworm cocoons are alive. Technical conditions”.

Interstate standard GOST 31308-2006 “Grenage cocoons. Technical conditions”.

These standards were adopted for the CIS countries by the decisions of the Interstate Council on Standardization No. 25-2004 dated 25.05.2004 and No. 29-2006 dated 24.06.2006 and by the decisions of the Uzstandard Agency DS/10 and DS/18 from January 1, 2005 and 2006 has been fully implemented in the cocooning system of Uzbekistan since October 15.

Interstate standard GOST 31354-2008 “Breeding cocoons of the silkworm. Technical requirements”. The state standard was adopted for the CIS countries by the decision of the meeting minutes of the Eurasian Council No. 33-2008 dated 06.06.2008 and is fully

implemented in Uzbekistan from August 1, 2008 by the decision of the Uzstandart Agency No. DS/6.

According to the results of research conducted in recent years, 52 breeds, parthenoclones and newly created systems have been created "Cadastre" for resistance to extremely dangerous diseases of mulberry silkworm (nosematosis and nuclear polyhedrosis). With the use of breeds with high disease resistance in production, the ground will be created for the future production of hybrid seeds of mulberry silkworm resistant to pebrina and yellow diseases.

A manual on the use of disinfectant "Khimiks" in silk industry was recommended. Currently, scientific and research work is being carried out on the use of modern antiseptic drugs during the worm and seed stages of mulberry silkworm.

Unique world collections (gene fund) of mulberry silkworms (120 breeds) and mulberry varieties (239 varieties and species) are stored at the Silk Industry Institute. According to the International Convention on Biological Species, signed by the Republic of Uzbekistan in 1995, the above-mentioned gene pools of silkworm breeds and mulberry varieties are the national wealth of Uzbekistan.

In recent years, scientific research works have been carried out on 1 fundamental, 10 practical, 1 innovative and 2 unique objects on the basis of state grants of the Silk Research Institute.

In recent years, scientists of the institute published more than 210 scientific articles in the local and foreign press, received 26 copyright certificates and 11 patents of Uzbekistan for inventions. 15 developments were presented at the republican exhibitions. 2 production management documents, about 40 recommendations, manuals and 8 monographs on the field were published.

The Silkworm Research Institute has been in scientific contact with foreign and CIS countries. Currently, events are being held from the people's Republic of China, Japan, South Korea, Vietnam, Bulgaria and the Commonwealth countries with a number of countries such as Russia, Ukraine, Azerbaijan, Georgia, Kazakhstan, Tajikistan and Turkmenistan to exchange information on various areas of silk production, publish scientific articles, participate in various conferences on the industry.

By the decision of the President of Uzbekistan dated March 29, 2017 "On measures to organize the activities of the Uzbekipaksanoat" association No. PQ-2856, the silk industry in Uzbekistan was united into one organization and a single chain system was created. The main goal of this is to further develop sericulture in our country by organizing cocoon cultivation and processing processes in a cluster method. Over the past 3-4 years, the volume of cocoon cultivation and the production of raw silk have been increasing in Uzbekistan.

If we dwell on some figures, it is planned to increase the total area of mulberry trees in Uzbekistan from 48,720 hectares in 2019 to 77,422 hectares by 2021, and the number of individual mulberry rows to 79,515,000 bushes (Figure 1).

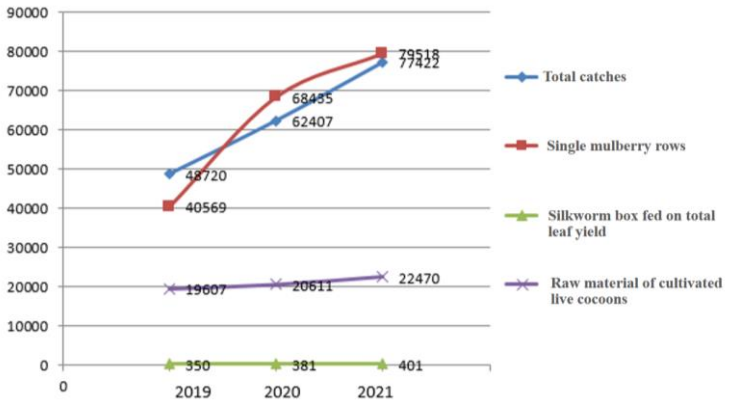

Fig. 1. Total area of mulberry trees in Uzbekistan.

Also, it is planned to increase the number of boxes of fed silkworms from 350,000 to 500,000 boxes, from 19,607 tons to 30,006 tons.

According to the latest 2018-2022 data, 11 seed production enterprises are operating in Uzbekistan, and by 2022 it is planned to increase their number to 13. The following histogram shows the forecast indicators for the cultivation of industrial silkworm seeds for the period 2019-2025 (Figure 2).

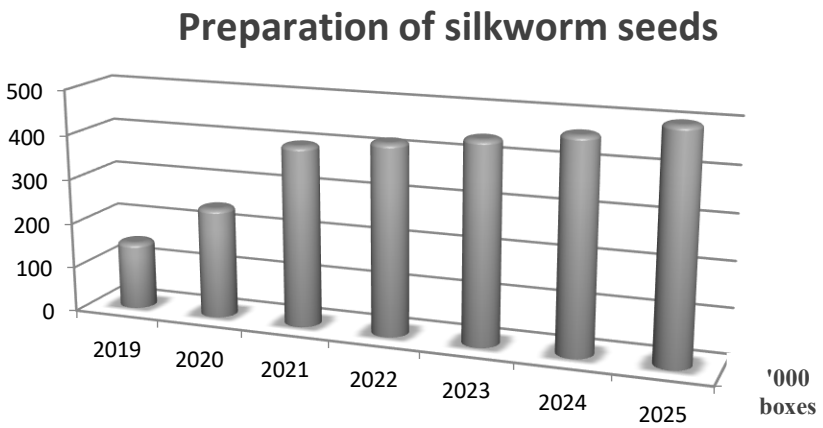

Fig. 2. Forecast indicators for the cultivation of industrial silkworm seeds.

As can be seen from Figure 2, in 2019-2025, the production of silk products increased by 1.5 times, that is, the production of raw silk is almost 3180 tons, the production of silk is up to 1060 tons, the production of silk yarn is up to 2182 tons, as well as the production of silk-based fabric is 24002 p.m. up to increase is projected.

4 Conclusions

By the decision of the President of Uzbekistan, the silk industry in Uzbekistan was united into one organization and a single chain system was created. The main goal of this is to further develop sericulture in our country by organizing cocoon cultivation and processing processes

in a cluster method. Over the past 3-4 years, the volume of cocoon cultivation and the production of raw silk have been increasing in Uzbekistan.

According to some trends, it is planned to increase the total area of mulberry trees in Uzbekistan from 48,720 hectares in 2019 to 77,422 hectares by 2021, and the number of individual mulberry rows to 79,515,000 bushes.

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