Effectiveness of special feeding mulberry plantations in optimal schemes depending on soil fertility and climatic conditions

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Abstract. To ensure the success of sericulture, it is crucial to establish special, dense, and intensive mulberry plantations in regions with suitable climatic and soil conditions. These plantations serve as an abundant and high-quality food source for silkworms, essential for their healthy growth and development. By carefully studying the climatic and soil conditions of each region, it is possible to design and implement systematic schemes for the establishment and maintenance of these special mulberry plantations. Depending on the age of the silkworms and the seasonality of feeding, these plantations can be utilized to optimize the feeding process and enhance the productivity of sericulture operations. The systematic use of special mulberry plantations can transform sericulture into a more profitable and economically efficient industry. By ensuring a consistent and high-quality food supply for silkworms, sericulture practitioners can improve cocoon quality and quantity, leading to increased silk production and profitability.

1. Introduction

In order to strengthen the food base of silkworms in countries where cocooning is developed, it is necessary to create new high-yielding and high-nutrition varieties of mulberry, based on the natural climatic conditions of the regions, and organize their breeding. It is of great scientific and practical importance to establish mulberry plantations providing special nutrients in clusters, households and farms due to new mulberry varieties with high productivity and economic value [1].

In the scientific institutions of the world's leading countries with developed sericulture science, with the rational use of mulberry genetic resources, through the effective use of in-vitro (molecular genetics), grafting and selection methods, intensively based on the creation of new varieties of mulberry with high yield, high nutritional value, suitable for different climatic conditions and as a result of scientific research on the establishment of bush mulberry plantations, the creation of mulberry varieties and hybrids suitable for seasonal feeding of silkworms and corresponding to various extreme climatic conditions is being achieved [2, 3].

In fact, in this regard, extensive work is being carried out in our country today to develop the silkworm feed base, to create and introduce into production new varieties of mulberry with high nutritional value for silkworm hybrids [4]. At the same time, scientific work on improving the efficiency of introduction of mulberry varieties by researching the compatibility of land areas with the local soil and natural climate, rooting, fertility and growth dynamics of mulberry varieties and the mechanism of influence on the yield of leaves obtained in different regions of Uzbekistan requires sufficient attention in further development and application of new advanced technologies [4, 5].

To enhance sericulture globally, efforts should focus on increasing the cultivation of mulberry trees and developing high-yielding mulberry seedlings. This involves expanding mulberry plantations that provide specialized nutrients, thereby boosting leaf yield. It's also important to enhance the mulberry tree's resilience to external environmental factors such as cold, drought, and salinity [6, 7].

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Several foreign authors have conducted scientifically-based experiments aimed at controlling diseases and improving the nutritional value of cultivated mulberry leaves [8-11]. These efforts contribute significantly to the sustainability and productivity of sericulture. By implementing these measures, the sericulture industry can become more efficient, sustainable, and resilient to environmental challenges.

2. Materials and Methods

In the section of the farms "Kuvnoq ota", "Asal momo", and "Chashma" farms belonging to the cluster "SILK EXPERT PROCESSING" LLC, Dostlik district, Jizzakh province (Uzbekistan), in the breeding of promising and foggy new varieties of mulberry and mulberry trees that give leaf yield and special feed In the maintenance of mulberry plantations, the characteristics of resistance to external conditions and the influence of the nutritional value of the cultivated mulberry leaf are studied.

It is scientifically based that the transformation of Hasaki mulberry varieties with low productivity into new promising and cultivated mulberry varieties depends on the agrotechnology of growing seedlings with a high level of resistance. New mulberry with high nutritional content, which is resistant to sudden changes in external environment, drought, salinity, is used in the establishment of mulberry plantations, which fully preserves its hereditary characteristics and provides special nutrients with high leaf yield. Breeding of bushes and intensive mulberry plantations based on varieties is analyzed.

Based on the study of new promising and regionalized varieties specific to the climatic environment and conditions of Jizzakh (Uzbekistan) to heat, cold, drought, diseases and pests, salinity, increasing the productivity and nutritional value of mulberry leaves, the remaining mulberry trees and special mulberry plantations are used for bushy and bushy and In the intensive type of mulberry plantations, the productivity of new promising or fogged mulberry varieties and the nutritional properties of mulberry leaves will be determined to continuously increase the food base of the silkworm.

3. Results and Discussion

In fact, in the areas of Uzbekistan specialized in cocoon breeding and related to cocoon cultivation, mulberry trees that produce leaves are planted on roadsides, along ditches, and around cotton fields. Accordingly, mulberry trees planted in rows make up 80-85% of the mulberry trees in the districts that grow cocoon raw materials.

In this regard, it was studied that bushy and intensive mulberry plantations, which give high leaf yield in different planting schemes, give a significantly higher yield than row and tall mulberry plantations from the first year of leaf use. In this case, in bushy mulberry plantations, fruiting bushes and branches are cut every year in the spring for leaf production, which makes it possible to carry out the specified agrotechnical measures between them, fertilizing and processing with the help of specified mechanization.

Therefore, today's narrow-row bush mulberry plantations are 4 x 0.5m, 3 x 0.5m, 2.5 x 0.5 and intensive mulberry plantations are 0.9 x 0.9 m, 0.9 x 0.6 m, 1.0 x 0.5, 1.4 x 0.5 m (Figures 1 and 2). Mulberry plantations and farms specializing in special mulberry production for the rational use of mulberry plantations and its leaves, which provide additional nutrients to mulberry trees during the period of planting and agrotechnical processing of intermediate crops until the harvest is ready for use , practical work is underway in clusters and farms.

Fig. 1. One-year growth rate of an intensive mulberry plantation established on the basis of seedlings grown horizontally from mulberry cuttings

In response to this, we can find out from the information obtained on the basis of the established task, the next scientific research work, which is analyzed above and is aimed at the solution of the current problem.

Therefore, the conducted experience and observations show that in the next 3 years, 65 hectares of new nutrient-giving mulberry plantations with high efficiency were established at the research object, due to the renewal of old mulberry plantations (Table 1).

Fig. 2. A view of a two-year bush mulberry plantation made of mulberry cuttings planted horizontally

According to the analysis of the data presented in Table 2, when mulberry is planted from a fertile mulberry seedling or a leafless cutting, growing branches with their own roots produce 3-4 or more fruitful branches from each cutting. In particular, intensive and bushy mulberry plantations established from leafless mulberry cuttings and fertile seedlings allow the use of its leaves in the second year.

Table 1. Growth rate and morphological indicators of bush mulberry plantations formed from horizontal mulberry cuttings

Mulberry varieties	Number of sprouted branches, pcs	Stem length		Thickness of the base of the rod, cm
		Average, cm	Total, m	
Uzbekistan	4	271	8.13	1.6
Mirzachul-6	3	238	7.14	1.4
Khasak (comparative)	2	219	4.4	1.2

As can be seen from Table 2, it was observed that the yield of leaves obtained from mulberries in the second year of bush mulberry plantations was 2.0-2.5 times higher than that of mulberry plantations grown from seeds. The method of propagating mulberries from cuttings is widespread in other regions of Uzbekistan. In order to establish a stable high-yielding and nutritious feed base for cocooning, the agrotechnics of propagation of mulberry seedlings from seeds and ringed cuttings (vegetatively) were developed, and the production of cocoon raw materials was introduced to the districts.

Table 2. Result of leaf yield in the second year of bush mulberry plantations established in optimal schemes based on misted mulberry varieties (on the basis of different mulberry varieties, 2022-2023)

Variety or hybrid of a mulberry tree	Selected planting schemes	From each hectare, ha	Relative to control, %
Mirzachul-6	3x0.5	167.3	239
Uzbekistan	4x0.5	149.8	214
Khasak (comparative)	2.5x0.5	70.0	100

In addition, the nutritional quality and satiety of the cultivated mulberry leaf is determined by the level of its consumption and digestion by the silkworm, as well as the amount of silk mass production. Therefore, there is an inextricable relationship between the nutritional quality of the leaf and the amount of silk wrapped by the worm that consumed it. Studying the nutritional quality of the leaf is of great importance in improving the agrotechnics of mulberry tree care, the use of mulberry leaves for silkworms, and the cultivation of new varieties. In general, the nutritional value of a leaf is determined in 3 different ways: biologically - that is, by feeding worms, chemically - by determining the elements contained in the leaf, and physically - by determining the physical properties of the leaf. Among them, the biological method is considered valid and effective.

In order to evaluate the leaf quality of mulberry cultivars or hybrids in a biological method, silkworms belonging to a certain breed or hybrid are fed with their leaves. In this case, 300 worms and a total of 900 worms are fed according to repetition, and 300 additional worms are also fed in order to make up for their number during the feeding of mulberry silkworms.

In this case, the quality control of mulberry leaves grown in special mulberry plantations organized in optimal schemes in the regions should be prepared in two periods (7-8 in the morning and 6-7 in the evening), and mulberry leaves should be kept in cool places under polyethylene films until the larvae hatch. In this case, the leaves of each mulberry variety or hybrid were measured for mulberry silkworms, and the feeding of the worms was carried out at the same agrotechnical level.

When determining the average parameters of the mulberry leaves taken by the sample, separately from the bush and tall mulberry plantations growing in different places and the inner part of the branches and the lower part of the branches located on the north, south, west, east sides. , the leaves from the middle and upper parts are pinched and sent for analysis. When we studied these physiological and biochemical processes in our scientific research work in the section of variants, the amount of pure protein in mulberry varieties was on average 22-25% in spring, 15-25% in summer, and 13-18% in autumn. At the same time, it can be seen that the leaf of the Uzbek variety has the highest protein content during the growing season, the Mirzachol-6 variety has an average amount, and the Khasak variety has a low level (Table 3).

Table 3. Changes in the amount of pure protein (protein) in mulberry leaves depending on the growth period and varieties of mulberry (in terms of dry matter, %)

Mulberry varieties	**Sampling periods depending on the worm feeding season**								
	26/4	**3/5**	**16/5**	**11/6**	**21/6**	**2/7**	**29/7**	**28/8**	**18/9**
Mirzachul-6	24.9	21.6	19.7	20.4	19.3	16.2	14.8	12.6	11.6
Uzbekistan	29.4	24.6	23.1	25.7	24.1	23.6	20.5	18.7	15.4
Khasak (comparative)	29.5	24.1	21.9	20.4	19.3	17.5	17.1	14.8	13.2

Analyzing the data in this table, the protein content of mulberry leaves decreased from spring to autumn. For example, when observations and scientific research were carried out on varieties, on average, it was around 20-25% in spring, 14-25% in summer, and 13-18% in autumn, according to samples taken at different times during the worm feeding season. the change of the protein in the chemical composition of the mulberry leaf with respect to dry matter was determined (Table 4).

Table 4. Changes in the relationship between total sugar content and sugar-protein content in mulberry leaves depending on the seasons of worm feeding

#	**Mulberry varieties**	**Periods of leaf preparation depending on the worm feeding season**								
		Spring			**Summer**			**Autumn**		
		26/4	**3/5**	**16/5**	**11/6**	**21/6**	**2/7**	**29/7**	**28/8**	**18/9**
Sugar - on the basis of dry matter										
1	Uzbekistan	10.1	11.1	12.4	10.6	10.7	10.2	10.3	12.0	10.8
2	Mirzachul-6	12.8	13.7	14.5	13.8	14.1	113.8	14.1	14.6	11.8
3	Khasak (comparative)	12.9	13.6	14.2	13.6	13.9	14.0	13.7	14.4	11.6
Interaction of sugar and proteins										
1	Uzbekistan	0.35	0.46	0.54	0.44	48	0.47	0.55	0.69	0.67
2	Mirzachul-6	0.43	0.55	0.63	0.53	0.58	0.58	0.70	0.78	0.77
3	Khasak (comparative)	0.44	0.65	0.69	0.68	0.72	0.75	0.81	0.97	0.87

From the data obtained in the section of the varieties in the table, it can be said that the kelchatka in the cultivated mulberry leaves is more in the morning compared to other periods, and starts to decrease in the evening. At the same time, it has been studied in research studies that the active substances in the leaf have a certain importance in improving the quality of the leaf.

1. The activity of the reaction in the hemolymph of the silkworm is equal to pH=6.7-6.8 during the period of worming and pupation, and the alkaline environment decreases during the period of shedding of the worm.

2. Ready-made nutrients contained in the hemolymph of the silkworm are linked to the activity of the reaction, that is, the pH in the blood of the worm decreases with the increase in the acidity of the food.
3. If the highest level of active acid in the mulberry leaf for silkworm is equal to pH=8.5-10.0, the worm will die. For normal growth of mulberry silkworm, pH should be around 6.0-6.5.
4. Young leaves are sour.

As they ripen, their acidity decreases. The leaves at the tip of the branch are also sour, and the sourness decreases as it goes down. Koklam contains more active substances and trace elements in the leaves than in the summer and autumn seasons. The content of vitamin C in the leaf also plays an important role in feeding the mulberry silkworm, and the increase in other micronutrients creates the basis for increasing the yield of cocoons.

In general, the results of the experiments carried out in areas with cocooning and varying climatic conditions and different soil fertility indicate that mulberries grown in specially fed mulberry plantations and consuming mulberry leaves with high nutritional value the biological indicators of the silkworm will increase and ultimately the quality indicators of the cocoons are higher (Table 5).

Table 5. Effects of feeding silkworms with leaves of mulberry plantations, which provide special nutrients based on misted mulberry cultivars, on the biological parameters of larvae and productivity of cultivated cocoons

Mulberry varieties	Larval viability, % X±Sx	Prolongation of the worm period, day	Totally wrapped cocoons, %	Cocoon yield from 1 box of worms, kg	Pd
Mirzachul-6	94.5±0.74	22	94.5	74	0.996
Uzbekistan	90.5±0.70	23	90.0	72	0.998
Khasak (comparative)	88.0±0.68	24.5	88.0	62	-

4. Conclusions

To enhance the nutritional quality of mulberry leaves for mulberry silkworms during cocooning, a thorough understanding of the local climatic and soil conditions is imperative. This knowledge enables the introduction of new mulberry varieties that are best suited to thrive in these specific environments. Additionally, establishing specialized feeding practices, such as optimal feeding schedules and controlled mulberry plantation management, is essential.

By implementing these measures, sericulture can be transformed into a more profitable and economically efficient industry. This approach not only ensures the sustainable use of mulberry plantations but also enhances the overall productivity and quality of silk production. As a result, the sericulture industry can thrive and contribute significantly to the local economy and community livelihoods.

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