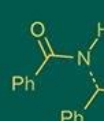


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Advances in mulberry cultivation techniques and their impact on silkworm growth and cocoon quality

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Abstract

Mulberry cultivation forms the foundation of the sericulture industry, as mulberry leaves serve as the sole food source for the domesticated silkworm (*Bombyx mori*). The quality and availability of mulberry leaves significantly influence silkworm growth, cocoon yield, and silk quality. In recent years, advances in mulberry cultivation techniques have played a vital role in improving productivity and sustainability in sericulture. Modern cultivation practices such as improved mulberry varieties, optimized nutrient management, efficient irrigation systems, integrated pest and disease management, and mechanized farming methods have enhanced leaf yield and quality. These improvements directly affect silkworm health, larval growth, cocoon weight, and silk filament length. Furthermore, climate-resilient mulberry cultivation techniques are increasingly being adopted to mitigate the effects of environmental variability on sericulture. This review highlights recent advancements in mulberry cultivation techniques and examines their impact on silkworm performance and cocoon quality. The integration of modern agricultural technologies with traditional sericulture practices can significantly enhance silk productivity and support sustainable development in the sericulture sector.

Keywords: Mulberry cultivation, sericulture, silkworm growth, cocoon quality, sustainable agriculture, silk production

1. Introduction

Sericulture is an important agro-based industry that integrates agriculture and animal husbandry through the cultivation of mulberry plants and the rearing of silkworms for silk production. It plays a crucial role in rural economies by providing employment opportunities and supporting the livelihoods of millions of farmers, particularly in developing countries. The foundation of successful sericulture lies in the quality and availability of mulberry leaves, which serve as the exclusive food source for the domesticated silkworm, *Bombyx mori*. Since silkworms are monophagous in nature, their growth, development, and silk-producing capacity are entirely dependent on the nutritional composition of mulberry foliage^[1-2]. Mulberry (*Morus* spp.) is a perennial and fast-growing plant that can adapt to a wide range of climatic and soil conditions. It is cultivated across tropical, subtropical, and temperate regions, making it one of the most versatile crops used in sericulture. Despite its adaptability, the productivity and quality of mulberry leaves are strongly influenced by several agronomic and environmental factors, including soil fertility, nutrient management practices, irrigation availability, climatic variability, and pest and disease incidence^[3]. Any imbalance in these factors can significantly affect leaf yield and quality, which in turn impacts silkworm health and cocoon production.

The nutritional composition of mulberry leaves is a key determinant of silkworm performance. Leaves rich in proteins, carbohydrates, vitamins, and essential minerals promote better larval growth, higher survival rates, and improved cocoon characteristics such as weight, shell ratio, and filament length. Conversely, poor-quality leaves with inadequate nutrient content can lead to stunted larval development, increased susceptibility to diseases, and reduced silk yield. Therefore, maintaining optimal leaf quality is essential for maximizing sericulture productivity and ensuring economic viability for farmers^[4]. Traditional mulberry cultivation practices have largely depended on the application of chemical fertilizers to meet the nutrient requirements of the crop. While these fertilizers can enhance plant growth and leaf yield, their excessive and unbalanced use has raised several environmental and agronomic concerns.

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Continuous use of chemical inputs can degrade soil structure, reduce microbial activity, and lead to nutrient imbalances. Additionally, significant portions of applied nutrients are often lost through leaching, runoff, and volatilization, resulting in low nutrient use efficiency and increased production costs ^[5]. These challenges highlight the need for sustainable and efficient nutrient management strategies in mulberry cultivation, modern agricultural practices have increasingly focused on improving resource use efficiency while minimizing environmental impact. Advances in mulberry cultivation have introduced several innovative approaches aimed at enhancing leaf yield and quality. The development of high-yielding and stress-tolerant mulberry varieties has significantly improved productivity under diverse environmental conditions. Improved irrigation methods, such as drip and sprinkler systems, have enabled efficient water use and reduced moisture stress, thereby supporting consistent leaf production.

Balanced nutrient management has also emerged as a critical component of modern mulberry cultivation. Integrated nutrient management approaches, which combine organic manures, biofertilizers, and chemical fertilizers, have shown promising results in improving soil health and sustaining long-term productivity. Organic amendments enhance soil structure and microbial activity, while biofertilizers contribute to nutrient availability through biological processes such as nitrogen fixation and phosphate solubilization ^[6]. These practices not only improve plant growth but also ensure environmental sustainability. Another important aspect of modern mulberry cultivation is the adoption of integrated pest and disease management strategies. Mulberry plants are susceptible to various pests and pathogens that can reduce leaf quality and yield. The use of eco-friendly pest control methods, including biological control agents and botanical pesticides, has gained popularity as a safer alternative to chemical pesticides. These approaches help maintain ecological balance while protecting crop health.

Climate change has introduced additional challenges to mulberry cultivation, including unpredictable rainfall patterns, temperature fluctuations, and increased incidence of pests and diseases. To address these challenges, climate-resilient practices are being incorporated into sericulture systems. Techniques such as mulching, improved pruning methods, and the selection of climate-adapted mulberry varieties help mitigate the effects of environmental stress and maintain consistent leaf production. In recent years, emerging technologies such as nanotechnology have opened new avenues for enhancing agricultural productivity. Nano-based inputs, including nano-fertilizers, have shown potential in improving nutrient delivery and uptake efficiency in crops ^[7]. Due to their small particle size and high surface area, nano-fertilizers can provide a controlled release of nutrients, reduce losses, and enhance plant growth. Their application in mulberry cultivation offers a promising strategy to improve leaf quality and increase sericulture productivity. However, further research is needed to optimize their use and assess their long-term effects on soil health and the environment.

The integration of advanced cultivation techniques with traditional sericulture practices has the potential to significantly improve both mulberry productivity and silkworm performance. By focusing on sustainable

approaches that enhance resource efficiency and minimize environmental impact, it is possible to achieve higher cocoon yield and better silk quality. Such improvements are essential for meeting the growing global demand for silk and ensuring the economic sustainability of the sericulture industry, the present review aims to provide a comprehensive overview of recent advancements in mulberry cultivation techniques and their impact on silkworm growth and cocoon quality ^[8]. The study emphasizes the importance of adopting innovative and sustainable practices to enhance leaf production, improve nutritional quality, and ultimately increase silk yield. By bridging the gap between agricultural practices and sericulture outcomes, this review contributes to the development of more efficient and environmentally responsible sericulture systems.

2. Importance of Mulberry Leaves in Silkworm Nutrition

Mulberry leaves constitute the sole natural diet of the domesticated silkworm (*Bombyx mori*), making them the most critical factor influencing the success of sericulture. The growth, development, and productivity of silkworms largely depend on the nutritional quality and availability of mulberry leaves ^[9]. Since silkworm larvae consume large quantities of leaves during their larval stages, the biochemical composition of the leaves directly affects larval health, cocoon formation, and silk yield. Consequently, maintaining high-quality mulberry leaf production is essential for ensuring efficient silkworm rearing and improved silk production.

Mulberry leaves are rich in essential nutrients required for silkworm metabolism and silk protein synthesis. These nutrients include proteins, carbohydrates, lipids, vitamins, and mineral elements that play important roles in larval growth and physiological development. Proteins and amino acids are particularly important because silk fibers are primarily composed of fibroin and sericin proteins ^[10]. High levels of protein in mulberry leaves support the development of the silk gland and enhance the production of these structural proteins, leading to improved silk quality and longer filament length.

Carbohydrates present in mulberry leaves serve as the primary energy source for silkworm larvae. They provide the energy required for metabolic activities such as digestion, growth, and silk synthesis. Adequate carbohydrate levels enable efficient energy metabolism, which supports faster larval development and higher survival rates. In addition, lipids present in mulberry leaves contribute to cellular functions and energy storage in the silkworm body ^[11]. Mineral nutrients also play a vital role in silkworm nutrition. Elements such as nitrogen, phosphorus, potassium, calcium, magnesium, and trace minerals are required for proper physiological functioning. Nitrogen is particularly important for protein synthesis and tissue growth in silkworm larvae. Phosphorus supports energy metabolism and cellular processes, while potassium helps regulate enzyme activities and osmotic balance. Calcium and magnesium contribute to muscle development and metabolic stability in the larvae ^[12]. The moisture content and physical characteristics of mulberry leaves also influence silkworm feeding behavior. Fresh leaves with high moisture content, soft texture, and tender structure are more palatable and easier for larvae to digest. Such leaves

improve feeding efficiency and nutrient assimilation, resulting in better larval growth and increased cocoon weight. In contrast, older or hardened leaves may reduce feeding efficiency and negatively affect silkworm development^[13-14]. The nutritional quality of mulberry leaves is influenced by several factors, including mulberry variety, soil fertility, climatic conditions, irrigation practices, and agronomic management. Improved mulberry varieties often possess higher protein content and better nutrient profiles compared to traditional varieties. Similarly, balanced fertilization practices and proper soil management enhance the nutritional composition of the leaves. Environmental factors such as temperature, humidity, and rainfall also affect leaf growth and nutrient accumulation^[15-17]. Inadequate soil management, poor irrigation, or nutrient deficiencies can significantly reduce the quality of mulberry leaves. Leaves produced under nutrient-poor conditions often contain lower levels of proteins and essential minerals, which can result in slower larval growth, higher mortality rates, and reduced cocoon production. Therefore, appropriate agricultural practices are necessary to maintain optimal leaf quality^[18-21]. Recent research has highlighted the importance of advanced mulberry cultivation techniques in improving leaf nutritional quality. Practices such as balanced fertilization, organic manure application, integrated nutrient management, and efficient irrigation systems have been shown to enhance leaf yield and nutrient content. These improvements contribute to healthier silkworm larvae, better cocoon characteristics, and increased silk productivity, the nutritional quality of mulberry leaves plays a decisive role in determining the performance of silkworms and the economic success of sericulture. Ensuring the consistent supply of high-quality mulberry leaves through improved cultivation practices is therefore essential for sustaining the productivity and profitability of the sericulture industry.

3. Advances in Mulberry Cultivation Techniques

3.1 Development of High-Yielding Mulberry Varieties

Plant breeding programs have developed several improved mulberry varieties with higher leaf yield, disease resistance, and better adaptability to different environmental conditions. High-yielding varieties such as V1, S36, and S54 have significantly improved mulberry productivity in many sericulture regions^[22]. These improved varieties produce larger leaves with higher nutrient content, which supports better silkworm growth and cocoon production. Additionally, some varieties are resistant to common pests and diseases, reducing the need for chemical pesticides.

3.2 Improved Soil and Nutrient Management

Soil fertility plays a critical role in mulberry growth and leaf quality. Modern mulberry cultivation practices emphasize balanced nutrient management using organic manure, chemical fertilizers, and biofertilizers^[23]. The application of nitrogen, phosphorus, and potassium fertilizers improves plant growth and increases leaf yield. Organic manure and compost enhance soil structure, improve microbial activity, and maintain long-term soil fertility. Biofertilizers such as nitrogen-fixing bacteria and phosphate-solubilizing microorganisms also contribute to sustainable mulberry cultivation.

3.3 Efficient Irrigation Techniques

Water management is an essential factor in mulberry cultivation. Traditional irrigation methods often lead to water wastage and uneven moisture distribution in the soil. Modern irrigation techniques such as drip irrigation and sprinkler systems provide efficient water distribution and reduce water loss^[24]. Drip irrigation delivers water directly to the plant root zone, improving water-use efficiency and promoting better plant growth. This technique is particularly useful in regions with limited water availability and helps maintain consistent leaf production.

3.4 Integrated Pest and Disease Management

Mulberry plants are susceptible to various pests and diseases that can reduce leaf yield and quality. Integrated pest management (IPM) strategies combine biological control methods, cultural practices, and limited chemical treatments to control pests in an environmentally sustainable manner^[26]. Regular monitoring of mulberry fields and the use of resistant varieties help prevent pest outbreaks. Biological control agents such as beneficial insects and microbial pesticides can effectively reduce pest populations without harming the environment.

3.5 Mechanization and Modern Farming Practices

Mechanization in mulberry cultivation has improved efficiency and reduced labor requirements. Modern equipment for pruning, harvesting, and leaf processing allows farmers to manage large plantations more effectively^[27]. Precision agriculture technologies such as soil testing, remote sensing, and digital monitoring systems are also being introduced in sericulture farming. These technologies help optimize nutrient application and irrigation management, leading to improved mulberry productivity.

4. Impact of Mulberry Cultivation Techniques on Silkworm Growth

Mulberry cultivation practices play a fundamental role in determining the growth performance, health status, and productivity of silkworms. Since mulberry leaves serve as the sole food source for the domesticated silkworm (*Bombyx mori*), the quality and availability of these leaves directly influence larval development and cocoon production. Modern mulberry cultivation techniques have significantly improved the nutritional quality, yield, and consistency of mulberry leaves, thereby positively affecting silkworm growth and silk production^[26-27]. Improved mulberry cultivation methods such as the use of high-yielding varieties, balanced fertilization, efficient irrigation systems, and proper pruning practices help enhance leaf production and nutritional value. When silkworms are fed with high-quality mulberry leaves, they show improved feeding efficiency, higher digestion rates, and better nutrient assimilation. These factors contribute to faster larval growth, shorter larval duration, and higher survival rates. Healthy larvae are more active and capable of converting the consumed nutrients into body mass and silk proteins, which ultimately leads to increased cocoon yield. The nutritional composition of mulberry leaves produced under improved cultivation practices is particularly important for silk synthesis. Mulberry leaves rich in proteins, amino acids, and carbohydrates support the proper development of the silk glands in silkworm larvae. The silk glands are responsible for producing fibroin and sericin, which are the primary proteins that form silk fibers. Adequate levels of

essential amino acids in mulberry leaves enhance the synthesis of these proteins, resulting in longer silk filaments, stronger fibers, and improved cocoon quality.

Advanced cultivation techniques also influence the biochemical composition of mulberry leaves [29]. The application of organic manure, biofertilizers, and balanced nutrient management increases the concentration of nitrogen and other essential nutrients in the leaves. Nitrogen is particularly important because it promotes protein synthesis in plants, thereby increasing the protein content of mulberry leaves. Higher protein levels in the leaves provide better nutrition for silkworm larvae and contribute to improved larval growth and cocoon formation [28]. Irrigation management is another critical factor affecting mulberry leaf quality and availability. Efficient irrigation techniques such as drip irrigation and sprinkler systems help maintain optimal soil moisture levels, which promotes consistent leaf production throughout the year. Continuous supply of fresh and tender leaves during the silkworm rearing period ensures uninterrupted feeding and prevents nutritional stress in larvae. Inadequate water supply can reduce leaf yield and quality, leading to poor silkworm growth and lower cocoon production [28]. Pruning and harvesting techniques also influence mulberry leaf productivity. Proper pruning encourages the growth of young shoots and tender leaves that are more suitable for silkworm feeding. These young leaves contain higher moisture content and better nutritional value compared to older leaves, making them more palatable and easier for silkworm larvae to digest. As a result, larvae fed with tender mulberry leaves exhibit improved feeding behavior and higher growth rates.

Another important aspect of mulberry cultivation is pest and disease management. Mulberry plants are susceptible to various pests and pathogens that can damage leaves and reduce their nutritional quality. Integrated pest management strategies, including the use of resistant varieties, biological control agents, and safe pest control methods, help protect mulberry plants and ensure the availability of healthy leaves for silkworm feeding, improved mulberry cultivation techniques contribute to enhanced silkworm growth, better larval health, and increased cocoon productivity. By ensuring the continuous supply of nutrient-rich mulberry leaves, these practices help optimize silkworm rearing performance and improve the efficiency of silk production [30]. Therefore, the adoption of advanced mulberry cultivation strategies is essential for the sustainable development and economic success of the sericulture industry.

5. Influence of Mulberry Leaf Quality on Cocoon Characteristics

Cocoon quality is one of the most critical economic parameters in sericulture because it directly determines the quantity and quality of silk produced. The characteristics of cocoons—such as cocoon weight, shell weight, shell ratio, filament length, filament denier, and tensile strength—are significantly influenced by the quality and nutritional composition of mulberry leaves consumed by silkworms during their larval stages [29]. Since mulberry leaves serve as the exclusive diet for *Bombyx mori*, any variation in leaf quality can have a direct impact on larval development and subsequent cocoon formation. High-quality mulberry leaves

contain adequate levels of proteins, carbohydrates, vitamins, and essential minerals that are required for proper larval growth and silk synthesis. Silkworms fed with nutrient-rich leaves typically produce larger and heavier cocoons with a higher shell ratio. The shell ratio represents the proportion of silk fiber in relation to the total cocoon weight, and a higher shell ratio indicates greater silk yield during the reeling process. Consequently, improved mulberry leaf quality contributes to enhanced productivity and profitability in sericulture. Protein content in mulberry leaves plays a particularly important role in cocoon formation because silk fibers are mainly composed of two proteins: fibroin and sericin. Fibroin forms the structural core of the silk filament, while sericin acts as a binding substance that holds the fibroin fibers together [32]. When silkworms consume mulberry leaves rich in proteins and amino acids, the silk glands develop more efficiently, allowing for increased synthesis of these proteins. This results in longer, stronger, and more uniform silk filaments. Carbohydrates present in mulberry leaves also contribute significantly to cocoon quality by providing the energy required for metabolic activities and silk production. Adequate carbohydrate levels support the energy demands of the larvae during the spinning stage, when large amounts of silk proteins are produced. In addition, minerals such as calcium, magnesium, and potassium play essential roles in regulating physiological processes that influence cocoon formation and silk filament strength [30]. The physical characteristics of mulberry leaves, including tenderness, moisture content, and freshness, further affect silkworm feeding efficiency and cocoon development. Tender and succulent leaves are more easily digested by silkworm larvae, which improves nutrient absorption and promotes healthy growth. This leads to the formation of well-developed cocoons with thicker shells and higher silk content. On the other hand, feeding larvae with mature or low-quality leaves may result in reduced feeding activity, poor larval development, and smaller cocoons with lower shell ratios.

Environmental and agronomic factors also influence mulberry leaf quality and, consequently, cocoon characteristics. Proper soil management, balanced fertilization, adequate irrigation, and the cultivation of improved mulberry varieties can significantly enhance leaf nutritional value. These improved cultivation practices ensure a consistent supply of high-quality leaves throughout the silkworm rearing period, which helps maintain uniform larval growth and cocoon formation. [32] Furthermore, research has demonstrated that mulberry leaves produced under optimized cultivation conditions can improve important cocoon parameters such as filament length, reelability, and silk strength. Longer silk filaments reduce the number of breaks during the reeling process and improve the overall quality of raw silk. Stronger silk fibers also enhance the durability and commercial value of silk products, the quality of mulberry leaves plays a decisive role in determining cocoon characteristics and overall silk productivity. Ensuring the consistent production of nutrient-rich mulberry leaves through improved cultivation practices is therefore essential for achieving high cocoon yield, superior silk quality, and sustainable development in the sericulture industry.

Table 1: Nutritional Composition of Mulberry Leaves and Their Role in Silkworm Development

Nutrient Component	Average Content in Mulberry Leaves	Role in Silkworm Growth
Proteins	18-28%	Essential for silk protein (fibroin and sericin) synthesis and larval growth
Carbohydrates	25-35%	Provide energy for metabolism and silk production
Lipids	3-8%	Support cellular functions and energy storage
Vitamins (A, B, C)	Trace amounts	Improve metabolic activities and immunity of silkworm larvae
Calcium (Ca)	1.5-2.5%	Supports physiological development and metabolic regulation
Magnesium (Mg)	0.3-0.6%	Important for enzyme activity and muscle function
Potassium (K)	1.0-1.8%	Maintains osmotic balance and enzyme activation
Moisture Content	65-75%	Enhances palatability and digestibility of leaves

Table 2: Modern Mulberry Cultivation Techniques and Their Benefits

Cultivation Technique	Description	Impact on Mulberry Productivity
High-Yielding Mulberry Varieties	Development of improved varieties such as V1, S36, and S54	Increased leaf yield and improved nutritional quality
Balanced Fertilization	Application of organic manure, NPK fertilizers, and biofertilizers	Enhances soil fertility and leaf nutrient content
Drip Irrigation	Controlled water supply directly to plant roots	Improves water use efficiency and promotes healthy plant growth
Integrated Pest Management (IPM)	Combination of biological, cultural, and minimal chemical control methods	Reduces pest damage and maintains leaf quality
Proper Pruning Techniques	Regular pruning to encourage young shoot growth	Produces tender leaves suitable for silkworm feeding
Mechanization	Use of modern tools for harvesting and plantation management	Reduces labor costs and increases cultivation efficiency

Table 3: Influence of Mulberry Leaf Quality on Silkworm and Cocoon Parameters

Mulberry Leaf Quality Factor	Effect on Silkworm Growth	Effect on Cocoon Characteristics
High Protein Content	Faster larval growth and better silk gland development	Increased cocoon weight and shell ratio
High Moisture Content	Improved feeding efficiency	Larger and well-formed cocoons
Balanced Mineral Content	Supports metabolic processes	Stronger silk filament and improved silk quality
Tender Leaf Texture	Easier digestion by larvae	Uniform cocoon formation
Adequate Carbohydrate Levels	Provides energy for larval development	Longer filament length and higher reelability

Table 3: Factors Affecting Mulberry Leaf Yield and Quality

Factor	Description	Impact on Mulberry	Effect on Silkworms
Soil Fertility	Availability of essential nutrients	Influences plant growth and leaf production	Determines nutritional quality of feed
Irrigation	Water supply and moisture availability	Affects leaf size and biomass	Impacts larval hydration and digestion
Climate	Temperature, humidity, rainfall	Controls growth rate and seasonal yield	Affects silkworm metabolism and survival
Pest & Diseases	Insect pests and pathogens	Reduces leaf quality and yield	Leads to poor larval health
Nutrient Management	Use of fertilizers and amendments	Enhances growth and biochemical composition	Improves cocoon quality
Cultivation Practices	Pruning, spacing, harvesting	Optimizes leaf production	Ensures continuous feeding supply

Table 4: Nutritional Composition of Mulberry Leaves and Their Role in Silkworm Growth

Component	Approximate Content	Role in Mulberry	Impact on Silkworms
Proteins	15-28%	Growth and metabolism	Enhances larval development and cocoon weight
Carbohydrates	20-30%	Energy source	Provides energy for silk synthesis
Lipids	2-8%	Structural and metabolic functions	Supports larval growth
Vitamins	Trace amounts	Enzyme activation	Improves immunity and metabolism
Minerals	Ca, Mg, K, Fe	Cellular functions	Enhances silk gland development
Moisture	65-75%	Maintains leaf freshness	Improves digestibility

Table 5: Advances in Mulberry Cultivation Techniques

Technique	Description	Advantages	Outcome in Sericulture
High-Yield Varieties	Improved mulberry genotypes	Higher leaf yield	Increased cocoon production
Drip Irrigation	Controlled water supply	Water conservation	Consistent leaf quality
Integrated Nutrient Management	Combination of organic and inorganic fertilizers	Improved soil fertility	Better leaf nutrition
Organic Farming	Use of natural inputs	Eco-friendly and sustainable	Improved silkworm health
Pruning Techniques	Regular trimming of plants	Promotes new leaf growth	Continuous leaf supply
Pest Management	Biological and eco-friendly control	Reduces crop damage	Healthy feeding material

Table 6: Comparison of Conventional and Modern (Nano-Based) Fertilization in Mulberry

Parameter	Conventional Fertilizers	Nano-Fertilizers
Nutrient Release	Rapid and uncontrolled	Slow and controlled release
Nutrient Use Efficiency	Low (30-50%)	High (up to 80-90%)
Environmental Impact	High (leaching, pollution)	Low (eco-friendly)
Cost Efficiency	Moderate to high (due to losses)	Cost-effective in long term
Effect on Leaf Quality	Moderate improvement	Significant improvement
Impact on Cocoon Yield	Limited increase	Higher cocoon productivity

6. Future Perspectives in Mulberry Cultivation

Future research in mulberry cultivation will likely focus on developing climate-resilient varieties, improving nutrient management practices, and integrating modern technologies into sericulture farming. Advances in biotechnology may also contribute to the development of genetically improved mulberry plants with enhanced nutritional content. Precision agriculture tools such as remote sensing, artificial intelligence, and digital farming platforms may help optimize mulberry cultivation practices and improve resource efficiency. These technologies can assist farmers in monitoring soil health, plant growth, and environmental conditions. Sustainable mulberry cultivation practices will play a key role in ensuring long-term productivity and environmental conservation in sericulture.

7. Conclusion

Mulberry cultivation is a fundamental component of the sericulture industry, as the quality and availability of mulberry leaves directly influence silkworm growth and silk production. Advances in mulberry cultivation techniques have significantly improved leaf yield, nutritional quality, and sustainability in sericulture farming. Modern practices such as improved mulberry varieties, efficient irrigation systems, balanced nutrient management, integrated pest control, and mechanized farming have enhanced mulberry productivity and supported better silkworm performance. These improvements have resulted in higher cocoon yields, improved silk filament length, and better overall silk quality, research and innovation in mulberry cultivation will be essential for meeting the growing global demand for silk while ensuring sustainable agricultural practices. An integrating modern technologies with traditional sericulture methods, the sericulture industry can achieve higher productivity and long-term sustainability.

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