

On Sustainable Development of Sericulture Industry

--An Empirical Study on Pengan County of Sichuan Province

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Abstract

Sericulture industry is a typical export-oriented industry, which is highly sensitive to world economic situation. The global financial crisis in 2008 caused a great impact on the sericulture industry of Pengan County in Sichuan Province. It further shows that traditional and single production and management mode of "cultivation-sericulture-cocoon-filature" is difficult to adapt to frequent fluctuation of international cocoon silk market. In order to overcome the difficulty and promote the sustainable development of sericulture industry of Pengan County, we have to actively explore new mode of production and management, strengthen comprehensive development and utilization of sericulture resources, broaden the value-added channels of sericulture industry, and improve the industry's overall economic efficiency.

Keywords: Pengan county of sichuan province, Sericulture industry, Mode of production and management, Sustainable development

1. Research Questions

Silk is one of the treasures of China. As a traditional industry of China, sericulture and silk industry has a long history of thousands of years. The development of sericulture and silk industry can achieve good ecological, economic and social benefit. Therefore, the sericulture and silk industry plays very important role to the economic and social development in China.

Pengan County is located in hilly area of Northeast Sichuan, which is the sericulture production base of Nanchong City. There are 20 sericulture base villages and towns at city or county level of the county currently. The sericulture and silk industry has always been the supporting industry of the county, as well as one of four major agricultural particular industries. The sericulture and silk industry has so strong base that it had the highest historical record of 100 thousand silkworms and 2.8 million kg cocoon, which brought sericulturists with the income of nearly 40 million Yuan, approximately accounting for over 25% of total revenue of agricultural sideline (Jiang, 2004). 40,508 silkworms and 1.27 million kg cocoon in 2008 are 6,000 and 200,000 kg more than those of 2006. However, due to lower price of cocoon caused by the price drop of silk and textile in international market, sericulturists' income heavily decreased by 2 million Yuan from 16 million in 2008. Because of the sharp decline of comparative economic benefit of sericulture and silk industry, sericulturists were dampened in production enthusiasm, and the industrial development dropped into low ebb. In many places, there has been no control on mulberries, no sericulture of silkworm, and even destroying and digging mulberries. All these indicate that traditional and single production and management mode of "cultivation-sericulture-cocoon-filature" is difficult to adapt to frequent fluctuation of international cocoon silk market. In order to overcome the difficulty, strengthen the base of sericulture industry of Pengan County, and lead the sericulture industry of the county bottomed out, we have to explore new mode of production and management, and broaden the value-added channels of sericulture industry

2. Difficulty and Problems Confronting the Development of Sericulture Industry in Pengan County

2.1 Single Production and Management Mode and Low Economic Efficiency

For a long term, Pengan County has been insisting on the mulberry cultivation mode of combining three sections, i.e. "small mulberry field, mulberry on four side, and intercropping mulberry", which has resulted in fragmented distribution, small-scale industrial structure, low level of large-scale, low quality of unit yield, and the sericulture industry has been the production and management mode of "cultivation-sericulture-cocoon-filature". The single development mode of "a tree, a leaf, a silkworm and a thread" inevitably lead to the high dependence of sericulture industry on the market condition of cocoon and silk. Moreover, the production value per mu of mulberry field is only between 1000 and 2000 Yuan, so the comparative benefit is rather low. The main reasons are as follows. Firstly, scattered and small-scale operation leads to low quality of cocoons. Moreover,

sericulturists are in passive position when selling cocoons. The buying companies deduct water or cut price on pretext of low quality. So the sericulturists' average income per silkworm is only 409 Yuan, lower than national average level. Secondly, the comprehensive utilization and development of mulberry field is not enough. On the comprehensive utilization and development of mulberry field, many places have achieved good experience, such as mulberry intercropping in garlic, leeks, green onions, spinach, etc. However, the mode of "small mulberry field, mulberry on four sides, and intercropping mulberry" in Pengan County is seldom paid attention on comprehensive utilizing and developing mulberry fields. Many scattered silkworm breeding households just regard sericulture as "sideline", and never pay attention to the management, protection and complex operation of mulberry field. For some larger households, they only interplant sweet potatoes, potatoes, corn and other crops with lower economic efficiency on comprehensive utilizing mulberry fields, without maximizing economic benefit.

2.2 Lack of Multi-leveled Utilization of Sericultural Resources

Sericultural resources can be classified into three categories: first, mulberry; second, silkworm and its outgrowth; third, silk. The multi-leveled utilization of sericultural resources refers to the comprehensive utilization of various outcomes of mulberry, silkworm and silk at three production levels.

Mulberry is a kind of economic species with strong environmental adaptation, whose fruit, leaf, twig and hull all can be used. Mulberry twig can be processed into sheet metal, fabric and paper, and can cultivate mushroom. Mulberry leaf can not only feed silkworms, but also be made into tea, as well as feed livestock. Its fruit can be processed into food and beverage. Silkworm resources consist of silkworm excrement and pupa produced during production process. Silkworm excrement has excellent medicinal value of healthcare, which can be made into pharmaceutical and excrement pillow and used as fertilizer or feed of pigs and fish. Chrysalis has high protein and nutrition but low fat, so it can be processed directly into food as a nutrient source. In addition to silk textiles, the hydrolyzed of silk has rich amino acids and peptides, so it can be the main raw material of skin care products and health food. Additionally, silk has excellent flexibility, moisture absorption, and air permeability, and good affinity on human cells. Along with wide penetration of biochemistry and molecular biology into many life science fields, silk, as a kind of biomedical material, has been developed on its use.

The above multi-leveled utilization of sericultural resources inevitably leads to higher economic benefit of the industry, and promotes the development of sericulture industry consequently. However, at present the utilization of mulberry outgrowth in Pengan County is at quite low level. A great deal of mulberry twigs was burned as firewood. The fruit covering mulberry is allowed to fall without attention. As for the leaves in non-sericulture season, they were just to serve livestock as feed. There is no consciousness at all on multi-leveled utilization of silkworm and silk resources during production process.

2.3 Lack of Investment Mechanism

In the development of sericulture industry, cocoons purchase firms and sericulturists are the main investors. However, due to the disorderly competition of cocoons purchase market, the purchase firms are not willing to invest as their investment income can't be guaranteed. Also the sericulturists wouldn't like to invest because of sharp increase and decrease of cocoon price and instable income. Thus, the development of sericulture industry confronts a serious shortage of necessary funds, leading to weakening of sericulture technology innovation, instability of technical service system, and lagging behind of infrastructure.

2.4 Risk Mechanism has not been Established

Sericulture and silk industry is a typical export-oriented industry, which has long industrial chain and complex process, spans both animals and plants fields, and involves the interests of agriculture, industry and trade as well. The source of the industrial chain is cultivating mulberries and silkworms. Mulberry is a kind of perennial economic crops, and silkworm is third-leveled breeding and four-leveled silkworm making. These two processes reflect relatively slow to market. When the international market demand declines, mulberries may have become forest, and silkworms have been made already. On the contrary, if they abandon, cut down and destroy mulberries on depressive international market, silkworms will decrease substantially. And it is difficult and slow to turn around on market upturn. In addition, mulberry and sericulture also have to confront the natural risks as worms of leaves and silkworms' illness. In order to enhance the risk prevention of sericulture industry and protect the stable development and the interests of producers and operators, it is very necessary to establish risk prevention system of the industry. At present, it is lack of risk prevention mechanism in Pengan County; therefore, sericulturists must experience a serious shock as soon as encountering sharp fluctuation of cocoon price and ill silkworms, which will greatly affect their confidence on the development of sericulture industry.

2.5 Shortage of Labor and Low Utilization of Mulberry Resources

The present population of Pengan County is 680,000, among which agricultural population accounts for 89%. There are 260,000 agricultural labors in the county, but 206,000 labors are migrant workers, and approximate 30,000 peasants move to cities to make a living, changing from previous business. The rest staying at rural areas are almost children, the elderly, the disabled, and other vulnerable groups. There are 11,000 sericulture households in based towns and villages of the county, only accounting for 23% of total households, and 1000 ones in non-based areas, accounting for only 0.85% of total in 2006. The shortage of labors becomes one of the important factors of restricting sericulture industry development. No control on mulberries and no sericulture of silkworm caused a big waste of mulberry resources. According to statistics, the utilization of mulberry resources in the county is less than 50% (Luo, 2008).

3. Viewpoints and Countermeasures on the Sustainable Development of Sericulture Industry in Pengan County

Under the impact of the global financial crisis, the cocoon silk price has fallen sharply, consequently firms and sericulturists have suffered a heavy blow, and many sericulturists begin to abandon and destroy mulberries. If this phenomenon keeps going, the sericulture industry base will inevitably be damaged enormously. In order to overcome the difficulty and promote the sustainable development of Pengan's sericulture industry, we have to actively explore new production and management modes and broaden income sources.

3.1 Change Traditional Single Production and Management Mode, Promote Economic Efficiency

In practice, many places have explored a number of effective production and management mode, such as the double three-dimensional mode of "mulberry-vegetables (chicken)", the planting and breeding mode of "mulberry-food-herd" and "mulberry-food-vegetables", and the multi-leveled circulation mode of "silkworm-livestock-biogas-fish", etc. The double three-dimensional mode of "mulberry-vegetables (chicken)" means that intercropping vegetables in mulberry fields. By this way, the overall profit of mulberry field increases, as mulberry feeds chicken, chicken manure fertilizers mulberry, mulberry pests reduce, mulberry grows better, mulberry provide chicken with comfort growing environment, and the quality of meet and egg production rate are quite high (Ding, 2008). The planting and breeding mode of "mulberry-food-herd" and "mulberry-food-vegetables" refers to systematic combination of mulberry three-dimensional planting and integrated utilization to improve overall economic efficiency of sericulture production and better promote the stable development of sericulture production (Liu, 2005).

Combining with the reality of Pengan County, the "silkworm-livestock-biogas-fish" circulation mode is a more suitable sustainable development mode, as sericulture, live pig and aquaculture are parts of agricultural supporting industry in Pengan County. The multi-leveled circulation mode of "silkworm-livestock-biogas-fish" combines these three supporting industries together systematically. The mode proper utilizes various resources; reduce the cost of developing one particular industry, so that it produces positive external effect between the production projects which have no contact before at all. It also applies the theory of circular economy, with efficient utilization of resources and recycling use as goals, to integrate resources and waste and turning waste into wealth, which can improve overall economic efficiency. From social ecological benefit perspective, mulberry can make mountains green, conserve water and soil, reserve water source, improve ecological efficiency, and accords with the national ecological policy of returning farmland to forest. The development of biogas is to solve the energy shortage in rural areas, and also in line with the development trend of clean energy.

3.2 Enhance Comprehensive Development, Promote Sericulturists' Income

Pengan County can focus on comprehensive utilization and development of mulberry field, and multi-leveled use of mulberry outgrowth with present technology and capital. However, certain attention also needs to be paid to the multi-leveled use of outgrowth of silkworm and silk, as they are probably a new growth point of future sericulture industry.

3.2.1 Strengthen Comprehensive Development and Utilization of Mulberry Outgrowth Resources

Firstly, mulberry twigs should be developed and used. Mulberry twigs can be processed into sheet metal, fabric and paper, and for cultivating edible fungus. The research results show that, the mulberry field of one mu can produce dry mulberry twigs by 500 kg. The dry mulberry twigs of 1 kg can cultivate fresh mushroom of 1 kg, i.e. 500 kg fresh mushroom per mu. If they are sold at average market price of 4 Yuan per kg, which can bring the new output value per mu is about 2000 Yuan (Liang, 2009). There are 80 thousand mu of mulberry fields in Pengan County, which bring 120 thousand tons mulberry twigs. If they are used to produce yuner, xianggu and other high-grade edible mushrooms, and improved on using rate to 50%, the production of fresh edible

mushrooms will reach to 40 thousand tons per year in the county, which can bring new value of about 150 million Yuan. If mulberry twigs are processed into sheet, the mulberry twigs per mu can be produced into 0.7-cubic meter wood, which is sold at 2000 Yuan per cubic meter. Therefore, sericulturists can gain new income of 1400 Yuan per mu by using mulberry twigs to process wood sheet (Liang, 2009).

Secondly, mulberry leaves should be developed and utilized. Mulberry leaves can be processed into green tea, besides sericulture. Lopping in summer and winter and abandoned tips and leaves from growing twigs in spring and autumn nearly account for 10% of total output. Calculated on 3000 kg leaves per mu, abandoned leaves are around 300 kg per mu annually. Pengan County has 80 thousand mu mulberry fields, so abandoned leaves per year reach to 24 thousand tons. If they are used to produce mulberry green tea, total yield will be 4 million kg. That is to say, they can bring 160 million Yuan income, if the green tea is sold at 40 Yuan per kg (Liang, 2009).

Thirdly, mulberry fruit should be developed and utilized. Mulberry fruit contains abundant vitamin, amino acid and microelement that clay needs. It has been honored by the State Health Ministry as one of the farm produce of “both food and medicament”, which has broad market prospect. It can be used to produce juice, wine, vinegar, red pigment, and so on. Mulberry vinegar has been developed and produced in South County near to Pengan. Therefore, Pengan can depend on southern mulberry vinegar factory to expedite renewing and transforming mulberry breed and to select widely used mulberry breed. Mulberry fruits never worry about market.

Additionally, silkworms can be fed with mulberry leaves. 1 mu of mulberry field can support 4-5 pieces of silkworm and produce cocoon by 150-180 kg per year. So the annual revenue of sericulture per mu is approximately 2400 Yuan on condition of 16 Yuan per kg in cocoon market (Liang, 2009).

Obviously, the comprehensive benefit is much more than single mode of planting mulberry or sericulture, through strengthening comprehensive development and utilization of mulberry outgrowth resources. So the firms and sericulturists will both gain much more income.

3.2.2 Do Well in Compound Business, Increase Economic Benefit

The compound business of mulberry field means applying hierarchical planting and feeding according to different biological characteristics, sufficiently use natural resources, find the growing potential of mulberry field, transform single mode into compound mode, and form a complementary biological structure of mulberry field (Zhang, 2002). The main implementations are as follows. Firstly, mulberry intercropping. For new established closed planting mulberry field, as the main body hasn't formed and the crown hasn't extended, some economic crops like vegetable and fruit can be intercropped on premise of no affecting mulberry's normal growth, such as greengrocery, radish, garlic, cabbage, lettuce, pumpkin, Chinese watermelon, cole, yam, sweet potato, earthnut, strawberry, melon, watermelon, medicinal materials, and so on. When mulberry has grown up enough to be forest, intercropping can stop. If it is long-term intercropping mulberry, row spacing must be arranged properly. Excellent crops should be selected for local intercropping, so as to improve the comprehensive economic efficiency of mulberry field. Secondly, feeding. It is a good use of space in mulberry field to feed chicken and ducks, and pick leaves. It brings mutual benefit. Chicken and ducks can prey on pests, make scarification, weed, and fertilize, which will reduce pest diseases and natural disaster for mulberry, cocoon, chicken and duck, enormously increase profit, and bring good ecological benefit.

3.3 Expedite Sci-Tech Innovation, Improve Overall Economic Benefit of Sericulture Industry

No any industry can maintain sustainable development without sci-tech innovation and application. In order to improve overall economic benefit of sericulture industry of Pengan County, one hand, we have to support leading enterprises with excellent technology, ability and market, to enlarge the investment in deep processing projects of silkworm and silk and produce high-quality silk and silk cloth; on the other hand, we need to expedite comprehensive utilization of mulberry, cocoon, their outgrowth, silk and sericulture resources to promote industrial sci-tech degree and overall economic benefit.

3.4 Innovation of System and Mechanism, Stability of Sericulture Industry Base

Firstly, focus on base cultivation. Emphasis should be put on establishing sericulture model base villages and towns. Supported by special villages, important communities and major owners, ordinary farm households can be led to convergent development of scale widely. Secondly, consummate the business mode of “firm + farmer” or “professional cooperation (coordination) + farm”. Silkworm and cocoon purchase firms should enclose market to establish base, implement the development by orders, establish benefit connection system, and strengthen preventive ability to market risks. Under the local government's support and encouragement, the professional cooperation communities and sericulture sci-tech unions of base villages and towns should consummate registration of industrial administration and tax, fulfill operation places, collect funds, begin

substantial implementation, and resolve difficulties and problems on market, capital and technology for sericulturists practically. Thirdly, transfer mulberry fields orderly. We should transfer the land and mulberry fields of the farm household's lack of labors or labors out, to major farmer in form of commission, leasing, subcontracting, transferring, exchanging, and so on, so as to effectively use sericulture resources. Fourthly, gradual establish insurance of sericulture industry. We should bring silkworm into subsidy scope of good genus, and establish risk funds of sericulture development, in order to provide sericultural production and management with risk security mechanism.

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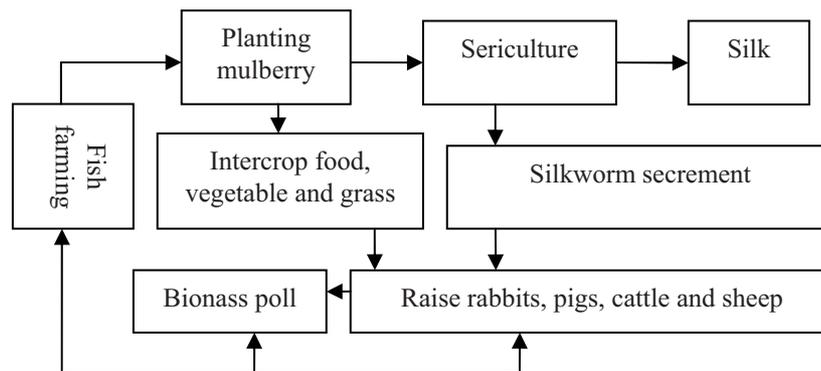


Figure 1. Multi-levelled circulation mode of "silkworm-livestock-biogas-fish"