

ESTABLISHING THE TECHNICAL ADVANCES APPLIED DEMONSTRATION OF SERICULTURE PRODUCTION IN YEN BAI PROVINCE

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ABSTRACT

Yen Bai province is considered as one of the few locations with largely concentrated areas under sericulture cultivation. Sericulture production has provided abundant jobs and opportunities for local residents, improved the lives of many households and reduced poverty in the area. The application of technological advances through large scale demonstrations is proved to be the best way for improving the economic efficiency of sericulture. In the duration of three years (2020 - 2022), 09 sericulture demonstrations covering a total area of 197.4 ha under mulberry cultivation have been established and developed with the participation of 370 local households, producing 11,562 silkworm egg cards in Van Chan and Tran Yen districts, Yen Bai province. Results conducted from the study showed that these demonstrations made a positive impact to the production of mulberry and silkworm as indicated by the increase of mulberry leaf and cocoon yield (21.89% and 13% higher than normal, respectively). In addition, the cocoon harvesting time reduced to 67.19%, the rate of good cocoon increased by 7.19%. 100% of the sericulture farmers are using wooden square mountages.

Keywords: *Sericulture, mulberry, silkworm, Yen Bai.*

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1. INTRODUCTION

Sericulture is regarded as one of the long traditional sectors in agricultural production of Vietnam. Nowadays, though various kinds of synthetic fibers have been produced with the rapid development of chemical industry, silk and silk used products are highly appreciated by the consumers because of its unique characteristics. The production of sericulture has become the main source of livelihood for 38,076 farming households and 101,705 sericulturists in 35/64 provinces across Vietnam, leading to a significant contribution to the socio-economic development in rural areas [1].

Sericulture has been developed in Yen Bai province since the 2000s. Over 20 years of trial and production in both small and large scale, sericulture was recognized and evaluated to have a significant contribution to the development of the provincial agricultural economy. It is obvious that sericulture

production played an important role in the developing of the agricultural sector of Yen Bai province. At present, 1,090 ha of land under mulberry cultivation is, mainly concentrated in 3 districts named Tran Yen, Van Chan and Van Yen. The expanded land area of 1,500 ha for mulberry production up to 2025 was also oriented by local authority in accordance with properly supported policies proposed from local authority [2].

However, the sericulture production in Yen Bai province has faced a lot of challenges. Lower yield (30 - 32 tons of mulberry/ha/year; 1 - 1.1 tons of cocoon/ha on average) and unsustainable cultivating system are some of the obstacles that need to be addressed and solved accordingly. Hand made activities have been popularly applied in almost every steps of sericulture production from mulberry planting to cocoon harvesting, and this method was already regarded to be out of date. Most of the cultivation stages such as mulberry planting, grass cleaning, fertilizer application, silkworm feeding, cocoon harvesting are done by hand that require a lot of labor as compared to advanced methods applied in

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developed sericulture countries i.e., China, India, Korea, etc. The main issues of the sericulture production system in Yen Bai province. Included small scale of production, low yield, low productivity, resulting in low income, lack of value chain linkage, investment and policy.

It is, therefore, necessary to apply newly introduced variety of mulberry and silkworm, combined with technological advances to improve the yield and quality of mulberry leaves, silkworm cocoon, thus improve the local farmer's livelihood in Yen Bai province.

2. MATERIALS AND METHODS

2.1. Materials

- Mulberry: F1 hybrid mulberry variety GQ2.
- Silkworm: Double cross silkworm variety BT1218 and double cross silkworm variety VH2020.
- Mountage: 03 types: 1. W bamboo mountage; 2. Wooden square mountage (25 mm x 45 mm, have 21 x 37 dimensions rectangles); 3. Withdraw bamboo mountage

2.2. Methods

- **Methods of mulberry cultivation** in accordance with the Agricultural Standard No. 10TCVN 489-2001: the technical procedure for planting, caring and harvesting of hybrid variety of mulberry, issued by the Ministry of Agriculture and Rural Development presented in Decision No. 121/2001/QD/BNN dated 21st November, 2001 [3].

- **Young age silkworm rearing method:** Approved by the Ministry of Science as improved technology by Decision No. 1415/QD-BKHCN dated 18th August, 2004 [4].

- **Late age silkworm rearing method on the floor:** Approved by the Ministry of Science and Technology presented in Decision No. 2243/QD-BKHCN dated 26th July, 2011 [5].

- **Effect of mountage types used for silkworm to release silk on yield, quality of cocoons and silk:** Field trials of 3 treatments were accordingly designed:

Treatment 1: Type of W bamboo mountage was used.

Treatment 2: Type of wooden square mountage was used.

Treatment 3: Type of withdraw bamboo mountage was used (control).

When spinning larvae, 2500 silkworms were randomly selected and fed on the mountages. After 4 days, cocoons were removed from the mountages for research.

** Methods to investigate the data and information:*

- Based on the Standard TCVN 1697 - 87 and Chinese Raw Silk Standard GB 1797 - 2001 (National Textile Industry Bureau, 2001) [6, 7]

- Followed "National technical regulation on procedure of experiment, testing breeding silkworms" - QCVN 01 - 74: 2011/BNNPTNT. Evaluation traits: cocoon yield (kg/6 gr eggs), cocoon weight, cocoon shell weight, cocoon shell percentage, average filament length, denier, rendital, reelability [8]

** Data analysis:* Analysis of variance (ANOVA) was performed using IRRISTAR 5.0

To conduct the field trials, Vietnam Sericulture Research Center (Vietseri) closely cooperated with the Agriculture Department of Yen Bai province and farmers of Van Chan and Tran Yen districts.

3. RESULTS AND DISCUSSIONS

3.1. The impact of newly introduced demonstrations to the growth of GQ2 mulberry variety

Table 1. Quantity of mulberry seeds sown and seedlings in 2020 - 2022

No.	Sowing time	Mulberry seed (kg)	Total harvest (seedling)	Standard seedling	Standard seedling rate (%)
1	2020	12	1,397,600	1,275,000	91.23
2	2021	25	3,137,000	2,995,000	95.47
3	2022	32	3,431,000	3,257,000	94.93
	Total	69	7,965,600	7,527,000	

Mulberry seeds were sown and taken care of in the nursery located in Kinh Mon district, Hai Duong province. About more than 60 days after sowing, seedlings of ≥ 0.40 m length considered as standard

ones were provided to farmers of Yen Bai province. Of the total 69 kg of mulberry seeds sown in the nursery, more than 91% seedlings were evaluated as standard ones (Table 1).

From the mentioned seedling quantity, 8 Yen districts during the year 2020 – 2022 that demonstrations of newly introduced mulberry variety covered an area of 194.7 ha in total with the coded GQ2 were established in Van Chan and Tran participation of 370 households (Table 2).

Table 2. Areas under mulberry cultivation in the demonstrations in 2020 - 2022

No.	Locations	Year	Area (ha)	Number of farmer household participated
1	Van Chan district (Son Thinh commune, Chan Thinh commune and Dong Khe commune)	2020	30	65
		2021	40	60
		2022	11.4	39
Sub- total			81.4	164
2	Tran Yen district (Y Can, Viet Thanh, Nga Quan, Quy Mong and Hoa Cuong)	2020	-	-
		2021	52	60
		2022	64	146
Sub- total			116	206
Total			197.4	370

Notes: (-) The project was started in Tran Yen district in 2021.

The growth of GQ2 mulberry variety in the demonstrations in Chan Thinh and Son Thinh communes of Van Chan district and Viet Thanh commune of Tran Yen district presented in table 3 showed that the variety is healthy in all 3 locations tested, as indicated by high survival, bud growing rates and big sized leaves.

Table 3. The growth of GQ2 variety in 3 demonstrations

Locations	Seedling survival rate (%)	Bud growing rate (%)	The length of tree (m)	Leaf size (cm)	
				Length	Width
Chan Thinh commune, Van Chan district	93.40	15.20	2.50	20.18	17.42
Son Thinh commune, Van Chan district	91.28	12.94	2.37	19.45	16.74
Viet Thanh commune, Tran Yen district	94.28	13.07	2.34	19.75	16.92
Average	92.99	13.74	2.40	19.79	17.03

When compared to Chinese variety, results in average) were much higher than the Chinese one conducted from the trials showed in table 4 stated (32.74 ton/ha/year) that the leaf yield of GQ2 variety (41.91 ton/ha/year)

Table 4. Leaf yield of mulberry GQ2 variety planted in 2021

No.	Locations	GQ2 variety (ton/ha/year)	Chinese variety (ton/ha/year)	Comparison rate (%)
1	Chan Thinh commune, Van Chan district	42.59	33.26	121.91
2	Viet Thanh commune, Tran Yen district	41.23	32.21	121.88
	Average	41.91	32.74	121.89

3.2. The impact of silkworm rearing technology to cocoon yield and income earned

3.2.1. Young age silkworm reared by Cooperatives

Young age silkworm of new double cross silkworm variety coded VH2020 was reared by 3

Cooperatives namely the Green Environment Cooperative of Chan Thinh commune (Tu famer), Son Thinh Sericulture Service Cooperative (Mong farmer) and Viet Thanh Sericulture Cooperative to provide fourth instar silkworms to famers in the demonstrations.

Table 5. Quantity of young agesilkworm reared by cooperative in 2020 - 2022 period

No.	Locations	Year	Number of harvests	Quantity of silkworm egg (egg card)
1	Van Chan district (Son Thinh commune, Chan Thinh commune)	2020	10	1,809
		2021	12	3,777
		2022	12	3,966
Sub- total				9,552
2	Tran Yen district (Viet Thanh commune)	2020	-	-
		2021	6	397
		2022	8	1,613
Sub- total				2,010
Total				11,562

Notes: (-) The project was started in Tran Yen district in 2021.

During 2020 – 2022, 11,562 silkworm egg cards were delivered to farmers at Van Chan and Tran Yen district (Table 5). Silkworm egg had good quality, hatching ratio of silkworm egg was reported more than 90% and free disease young age silkworm of good quality was also obtained.

3.2.2. Late age silkworm rearing

In the scale of the project, farmers who reared silkworm come from 3 communes (Chan Thinh, Son Thinh and Viet Thanh). They were trained by skilled experts and provided with sufficient quantity of

disinfectants, preventive drugs and young age silkworm as well. In addition, farmers were also instructed on the detailed techniques of spreading silkworms on the floor by rows and how to feed and take care of silkworms at different stages including molting one.

In general, the cocoon yield in 2022 was in significantly higher compared to 2021 in Chan Thinh demonstration and no high fluctuation from harvest to harvest was also recorded (Table 6).

Table 6. Yield of silkworm cocoon in different demonstrations in 2020 - 2022 period

No.	Location	Year	Quantity (egg card)	Cocoon Yield (kg/card)	Cocoon yield (ton/ha/year)
1	Chan Thinh commune, Van Chan district	2020	1,809	9.84	1.18
		2021	2,514	10.12	1.12
		2022	2,526	10.83	1.30
2	Son Thinh commune, Van Chan district	2020	-	-	
		2021	986	9.05	1.09
		2022	1,416	10.02	1.20
3	Viet Thanh commune, Tran Yen district	2021	397	10.50	1.26
		2022	1,613	11.10	1.33

It is also mentioned that the skill of farmers participated in the project in terms of silkworm rearing technology significantly improved, resulting in an increase in the cocoon yield year by year.

Data summarized in table 7 showed that cocoon

yield gradually increased. In addition, the cocoon price increased considerably during 2021 - 2022, which helped increase the income of producers. To illustrate, in Son Tinh commune, the income earned from a silkworm egg card in 2022 increased by 19.52% compared to 2021.

Table 7. Average in come earned from a silkworm egg card in 2020 - 2022 period

No.	Locations	Year	Cocoon yield (kg/card)	Cocoon price/kg (VND)	Average in come/silkworm egg card (VND)	Production value increase (VND)
1	Chan Tinh commune, Van Chan district	2020	9.84	92,000	905,280	-
		2021	10.23	120,000	1,227,600	322,320
		2022	10.83	129,000	1,297,500	169,900
		Comparison 2021 to 2022	5.89	7.50	13.84	
2	Son Tinh commune, Van Chan district	2020	-	-	0	
		2021	9.47	108,000	1,022,760	-
		2022	9.86	122,000	1,212,420	199,680
		Comparison 2021 to 2022	5.81	12.96	19.52	

In Chan Tinh commune:

- As a matter of fact, the cocoon yield of silkworm variety LQ2 (Chinese variety), reared by farmers who did not participate in the project (outside of the demonstrations) was much lower

than domestic ones reared by project participants (9.08 compared to 10.23 kg/egg card, 13% fluctuation). Therefore, the income for 1 egg card in the demonstrations was much higher than outside fields (356,200 VND increased; table 8)

Table 8. Average in come earned from a silkworm egg card in 2021 at Chan Tinh commune

No.	Types	Cocoon yield (kg/eggcard)	Cocoon yield increased (%)	Average in come/egg card (VND)	Average in come/egg card increased (VND)
1	Demonstration	10.23	113	1,27,900	356,200
3	Normal fields	9.08		871,680	-

3.3. Impact of improved mountage types to the quality of cocoon and raw silk

With the assistance from skilled technicians from research institutions, newly improved mountages were done by the participating farmers who have been instructed with the techniques

concerned, such as the way to place ripen silkworms crawl on the mountages, how to remove cocoon, etc. Data summarized in table 9 proved that the types of mountages significantly affected the quality of cocoon.

Table 9. The effect of the mountage to cocoon quality in Chan Tinh commune

No.	Contents	Bamboo mountage	Wooden square mountage
1	Cocoon whole weight (g)	1.46	1.61
2	Cocoon shell ratio (%)	18.19	19.37
3	Double cocoon ratio (%)	6.12	1.77
4	Silk length (m)	774	871
5	Reelibility (%)	76.72	84.10
6	Silk waste percentage (%)	1.80	1.62
7	Rendital (kg)	7.86	7.04
8	Grate of cocoon quality	5G/10G	6G/10G

It is obvious that the types of mountage affected not only the quality of cocoon but also the yield of silk and cocoon, even when silkworms had already stopped eating mulberries in the cocooning process. For the mountages made of hygroscopic materials and suitable space for cocooning, silkworms produced cocoons easily, spent less quantity of original silk to shape the cocoon shell and higher yield of cocoon with better silk quality was also reported. Among the types of mountages tested, wooden square mountage was considered to have many advantages. The cocoons obtained in this type of mountage were quite uniform and clean due to the limitation of yellow stains secreted by silkworms. The cocoon yield was 10.24% higher than the control while the cocoon harvesting time reduced to 67.19%. Moreover, the rate of good cocoon increased by 7.19%, very few double cocoon and waste cocoon was reported. All the criteria related to cocoons quality obtained in wooden square mountages were better

than the others, indicated by the length of cocoon filament (12.62% longer), the reelability (11.06% higher), cocoon quality ranked at 6G level, where as reeling silk size of 20 – 22 D was already recorded from cocoons harvested in wooden square mountage which was evaluated at grade 2A, better than bamboo mountage (3A grade) [9].

Since press tool can be used for taking cocoons out from wooden square mountage, the time to harvest would be shorter than W bamboo mountage and withdraw bamboo one that have to be done by hand.

Besides, the cocoon yields in wooden square mountage were higher than withdraw bamboo mountage (10.24%).

Reelability is an indicator that depends on the environmental conditions in which temperature and relative humidity during the larva spinning play an important role.

Table 10. Effect of mountage type to silk quality (20 - 22D raw silk)

No.		W bamboo mountage		Wooden square mountage		Withdraw bamboo mountage (control)	
		Reality	Grade	Reality	Grade	Reality	Grade
1	Average Conditioned Size (D)	20.21	Good	20.37	Good	19.78	Good
2	Size Deviation (den)	2.2	A	1.81	2A	1.96	A
3	Maximum Sizing Deviation (den)	4.71	3A	3.98	4A	4.26	4A
4	Cleanness	88	2A	89.50	2A	87.67	A
5	Neatness	97.60	5A	98.90	6A	96.83	4A
6	Appearance Inspection	No white colour, Soft		White colour, Soft		No white colour	
7	GRADE	A		2A		A	

Using wooden square mountage, the cocoon quality was highly appreciated, as indicated by higher ratios of cocoon shell, reelability, rendital compared to bamboo mountage.

In short, it can be said that mountage types had a significant impact on

the yield and quality of cocoon produced by silkworms. As a result, wooden square mountages have been popularly utilized in most silkworm farms in Van Chan and Tran Yen districts of Yen Bai province (Table 11).

Table 11. Percentage of farmer using wooden square mountage to rearing silkworm in Yen Bai province

No.	Locations	2020	2021	2022
1	Chan Thinh commune, Van Chan district	20	80	100
2	Son Thinh commune, Van Chan district	20	50	100
3	Viet Thanh commune, Tran Yen district	80	100	100

4. CONCLUSION

The application of technical advances in the form of over-all demonstrations had a positive effect on sericulture production in Yen Bai province, indicated by improving the health of mulberry (21.89% higher leaf yield compared to the control), the yield of cocoon (13% higher than the control); the shortening of harvest duration (67.9% shorter than usual) and the quality of cocoon (7.19% higher in good cocoon ratio than the control).

Utilization of wooden square mountage in rearing silkworm remarkably improved remarkably the quality of cocoon released and this device has been used by nearly 100% sericulture farmers up to now.

The demonstrations of over-all technical advances increased significantly the income of sericulture farmers, thus improving their living standards.

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REFERENCES

1. Le Hong Van, Do Minh Duc, Nguyen Thi Nhai, Nguyen Huu Duong (2022). Vietnam Sericulture Current Situation and Solution for Sustainable Development. *International Symposium Sustainable Sericulture Development*. Ha Noi. Vietnam. p: 1-12.

2. Policies to support the development of agricultural, forestry and fishery production in Yen Bai <https://thuvienphapluat.vn/van-ban/Dau-tu/Nghi-quyet-69-2020-NQ-HDND-chinh-sach-ho-tro-phat-trien-san-xuat-nong-lam-nghiep-thuy-san-Yen-Bai-462498.aspx>

3. Ministry of Agriculture and Rural Development - MARD (2001). Decision No. 121/2001/QD/BNN dated 21st November, 2001: The technical procedure for planting, caring and harvesting of hybrid variety of mulberry (in Vietnamese).

4. Ministry of Science and Technology – MOST (2004). Decision No. 1415/QD-BKHCHN dated 18st August, 2004: The technical for young age silkworm rearing (in Vietnamese).

5. Ministry of Science and Technology – MOST (2011). Decision No. 2243/QD-BKHCHN dated 26st July, 2011: The technical for late age silkworm rearing (in Vietnamese)

6. Viet Nam Standard: TCVN 1697-87- Mulberry raw cocoons-specifications (in Vietnamese).

7. Chinese Raw Silk Standard GB 1797 – 2001 (National Textile Industry Bureau, 2001).

8. QCVN 01 - 74: 2011: National technical regulation on procedure of experiment, testing breeding silkworms (in Vietnamese).

9. Le Hong Van, Do Minh Duc, Pham Thi Phuong, Kang Pildon, Bui Quang Dang, Nguyen Huu Duong, Hong Seung Gil, Hyun Jong Nae, Le Ngoc Lan (2022). Effect of mountages for silkworm to release silk on yield, quality of cocoons and. *Journal of Vietnam Agricultural Science and Technology* 6(139): 104- 110 (in Vietnamese).