Ministry of Agriculture, Livestock and Irrigation
Department of Agriculture (DOA)

Assessment of Yield and Quality of Silkworm Cocoon by Feeding Different Mulberry Varieties (*Morus alba*)

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INTRODUCTION

- Sericulture has been practiced in many developed and developing countries in the world for a long time.
- Sericulture started in Myanmar since 7th century and modern sericulture was established in 1952.
- In Myanmar, silkworm rearing has been seemingly practiced from the ancient time in a rural area and it is still done as a cottage type in a traditional way.
- In Myanmar, mulberry plants are grown in Kachin State, Kayah State, Chin State, Shan State, and Mandalay Region covering with 2606 ha in 2017 (DOA, 201**8)**

- Sericulture is the rearing of silkworms, *Bombyx mori* L. for the production of raw silk.
- About 92.20% of the silk produced in the world is obtained from mulberry silkworm reared solely on mulberry leaves (*Morus* spp.).
- Silkworm is essentially a monophagous insect which feeds solely on mulberry leaves.
- Growth and development of silkworm is known to vary depending on the quality and quantity of mulberry leaf used as food source, which in turn indicated by commercial characteristics of cocoon crop (Nagaraju, 2002).

- In sericulture, the success of the sericulture industry depends on the performance of silkworm and mulberry varieties .
- The lower yield of silk production may be due to the inferior quality of mulberry varieties.
- Therefore, to improve sericulture industry in Myanmar, it is worth to find out the ways to produce high yield and good quality of cocoon by feeding the suitable mulberry variety.

OBJECTIVES

1) To verify the suitable mulberry variety for high yield and good quality cocoon production

2) To distribute the suitable mulberry variety to silkworm rearers in various regions of Myanmar

MATERIALS AND METHODS

- Four mulberry varieties viz., Myanmar Large Leaf, Pauk Khaung, BR-60 (Thailand), and KSS (China) in Pyin-Oo-Lwin Sericulture Research and Development Center were used to feed the bivoltine strain of silkworm in this study.
- The commercial silkworm strain N_{24} Kachin x IN_{06} was used by feeding different mulberry varieties in this study for cocoon production.

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Figure 1.The Characteristics of Myanmar Large Leaf

Figure 2.The Characteristics of Pauk Khaung

Figure 3.The Characteristics of BR-60 (Thailand)

Figure 4.The Characteristics of KSS (China)

Silkworm Rearing

- Four mulberry varieties viz., Myanmar Large Leaf, Pauk Khaung, KSS (China) and BR-60 (Thailand) were feed to silkworm strain (N_{24}Kachin x In_{06}) in Pyin-Oo-Lwin Sericulture Research and Development Center at different times (23. 4. 2019, 5. 12. 2019 and 26. 8. 2020).
- For each mulberry variety, 4 grams of eggs laying were reared.
- At 4^{th} instar, 400 larvae for each variety were maintained.

Moth inspection

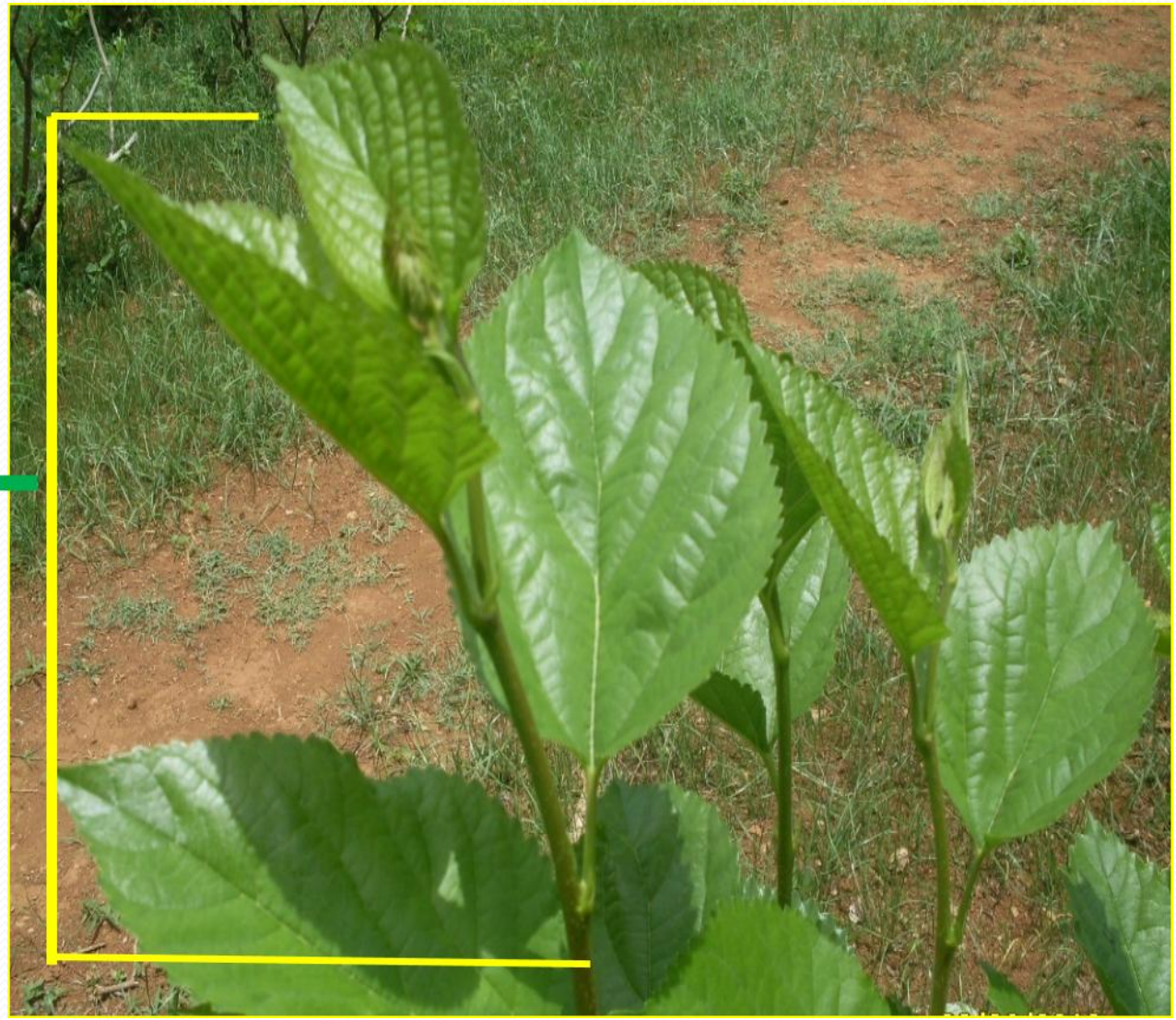
Silkworm Rearing- Young larvae

Silkworm Rearing (Young larvae)

- Larvae were fed four times daily (6 am, 10 am, 2 pm and 5 pm) with healthy and fresh mulberry leaves. Young larvae (from first to third instars) were fed with tender, succulent and nutritious leaves known to favour growth and development of silkworms, while mature and coarse leaves were fed to grown silkworms (from fourth to fifth instars) till ripening.
- Cocoons were collected after 7^{th} day of mounting and assessed for commercial parameters by Sonwalkar (1991) methods.

Mulberry Leaf

for first, second and third instars



For young larvae (first to third instars)

For fourth to fifth instars

For grown silkworms (fourth and fifth instars)

Silkworm Rearing (Grown larvae)

Data Collection

Growth and quality parameters

- Style of feeding
- Hatchability (%)
- Larval duration (days)
- Total weight of cocoons (lb)
- Number of cocoons per pound
- Average silk percentage (fresh)

After reeling test, the following parameters were collected.

- Average length of silk yarn per cocoon (m)
- Average non-breaking length of silk yarn per cocoon (m)
- Estimated dry reelable percent (%)

Experimental Design

For all studies, simple trial was used with 4 treatments and each experimental unit included 300 larvae. The treatments of four mulberry varieties were as follows.

- Myanmar Large Leaf
- Pauk Khaung
- BR-60 (Thailand)
- KSS (China)

RESULTS AND DISCUSSION

- The performance of four mulberry varieties viz., Myanmar Large Leaf, Pauk Khaung, BR-60 (Thailand) and KSS (China) were evaluated at Pyin-Oo-Lwin Sericulture Research and Development Center from 2019-2020.
- The results of mulberry feeding were presented in Table 1, 2 and 3. No significant differences were observed in larval duration and percentage of hatchability.

- Silkworm rearing performance differed significantly on cocoon production by varieties of mulberry leaves and nutritive effects of leaf position play a major role in the quality of silkworm growth and silk production (Adeduntan, 2013 and 2015).
- Similar result was found in this study which shows that KSS (China) and Myanmar Large Leaf gives better results in larva and cocoon characters compared to other varieties tested.

Table 1. Performance of cocoon produced from four mulberry varieties in summer season (23.4.2019)

Mulberry Varieties	Quality Parameters of Cocoon		
	Total cocoon weight (lb)	Number of cocoons per pound	Average silk percentage (%)
Myanmar Large Leaf	3.45	338	15.70
Pauk Khaung	2.88	351	14.47
BR-60 (Thailand)	3.00	387	15.54
KSS (China)	3.44	339	15.66

Table 2. Performance of cocoon produced from four mulberry varieties in winter season (5.12.2019)

Mulberry Varieties	Quality Parameters of Cocoon		
	Total cocoon weight (lb)	Number of cocoons per pound	Average silk percentage (%)
Myanmar Large Leaf	5.06	200	16.05
Pauk Khaung	5.06	193	16.62
BR-60 (Thailand)	4.75	200	15.62
KSS (China)	6.30	187	18.64

Table 3. Performance of cocoon produced from four mulberry varieties in rainy season (26.8.2020)

Mulberry Varieties	Quality Parameters of Cocoon		
	Total cocoon weight (lb)	Number of cocoons per pound	Average silk percentage (%)
Myanmar Large Leaf	4.81	231	17.49
Pauk Khaung	4.44	259	16.74
BR-60 (Thailand)	4.31	251	16.63
KSS (China)	4.44	259	16.19

- Cocoon weight and silk percentage are the most important characters evaluated for productivity (Gaviria *et al*., 2006). Silk percentage indicates the amount of raw silk reeled from given quantity of fresh cocoons.
- Higher cocoon weight, fewer number of cocoons per pound and higher fresh silk percent recorded in mulberry varieties, KSS (China) in winter season and Myanmar Large Leaf in summer and rain seasons.

- Results revealed that, in summer (2009) and rainy (2020) reeling test, mulberry var. Myanmar Large Leaf recorded the highest estimated dry reelable %, the highest average length per cocoon and average non-breaking length of cocoon (in m) (Table 4 and 6).
- Among the mulberry varieties tested, in winter (2019) reeling test the highest estimated dry reelable % and the highest average length per cocoon was recorded in KSS (China) variety (Table 5).

Table 4. Average length(m) of silk yarn per cocoon, average non-breaking length (m) of silk yarn per cocoon and estimated reelable percent of four mulberry varieties in summer season (23.4.2019)

Mulberry Varieties	Quality Parameters of silk yarn per cocoon		
	Average length per cocoon (m)	Average non-breaking length per cocoon (m)	Estimated reelable percent (%)
Myanmar Large Leaf	865.12	511.93	26.74
Pauk Khaung	628.94	470.44	26.16
BR-60 (Thailand)	603.19	432.82	26.50
KSS (China)	603.19	432.82	25.54

Table 5.Average length(m) of silk yarn per cocoon, average non-breaking length (m) of silk yarn per cocoon and estimated reelable percent of four mulberry varieties in winter season (5.12.2019)

Mulberry Varieties	Quality Parameters of silk yarn per cocoon		
	Average length per cocoon (m)	Average non-breaking length per cocoon (m)	Estimated reelable percent (%)
Myanmar Large Leaf	791.94	670.70	31.00
Pauk Khaung	796.41	741.27	30.27
BR-60 (Thailand)	804.92	752.70	31.84
KSS (China)	876.52	712.30	33.22

Table 6. Average length(m) of silk yarn per cocoon, average non-breaking length (m) of silk yarn per cocoon and estimated reelable percent of four mulberry varieties in rainy season (26.8.2020)

Mulberry Varieties	Quality Parameters of silk yarn per cocoon		
	Average length per cocoon (m)	Average non-breaking length per cocoon (m)	Estimated reelable percent (%)
Myanmar Large Leaf	826.26	582.51	31.87
Pauk Khaung	742.84	447.79	29.41
BR-60 (Thailand)	648.71	470.18	28.21
KSS (China)	679.92	433.83	28.38

- Cocoon filament length is one of the important economic traits. All mulberry varieties recorded significantly higher filament length among the mulberry varieties tested in this study.
- According to FAO (1999), total silk filament length is ranging from 600m-1500m out of which only 80% is reelable. In the present study, Myanmar Large Leaf and KSS (China) were produced longest filament lengths.

CONCLUSION AND SUGGESTION

- Present results revealed that feeding performance of KSS (China) and Myanmar Large Leaf showed good economic cocoon characters such as total cocoon weight, cocoon size and average silk percentage, silk filament with higher reelability compared to other varieties.
- From this research, it has been concluded that KSS (China) mulberry variety and Myanmar Large Leaf can produce the suitable quality and high yield of cocoon among the varieties tested and consequently, that varieties can be distributed to not only government silkworm farms but also private rearers in Myanmar.

THANK