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Research Article

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Study on comparative reeling performance of improved Thai reeling machine and Traditional Ghai reeling machine for quality raw silk production

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ABSTRACT

A Thai reeling machine with (Dual Operative System) has been fabricated at BSRTI for the production of raw silk with high quality and quantity. The experiment was done by four different seasons to determine the cocoon characteristics and reeling performances on the Thai reeling machine. Mean renditta, raw silk recovery (%), reelability (%), waste (%) were found to be 9.74, 71.81%, 63.26% and 5.36%. It was also found that the mean tenacity and elongation percentage were 3.13 (g/d) and 18.74% in the Improved Thai reeling machine, whereas it was 2.87 (g/d) and 18.70% in the Traditional Ghai respectively. BSRTI fabricated an Improved Thai reeling machine (Dual driving system) was suggested as an improved reeling appliance commercially to get high quality raw silk production.

KEYWORDS: Improved Thai reeling machine, Reeling performance, Quality raw silk production

INTRODUCTION

Traditional Katghai and Thai reeling machine are widely used for coarse raw silk production in rural sericulture-oriented areas of Bangladesh. Besides this, Charka is used for spinning spun silk from cut cocoons, brushing waste (Jute) and reeling basin waste (Topa). But maximum quantity of coarse raw silk is being reeled on traditional Katghai reeling machine. In spite of development of improved methods and reeling techniques most of the reelers are still following traditional reeling methods. In traditional Katghai reeling methods cocoons are cooked in a big mud chari placed on a clay platform at boiling temperature and just after removing the upper layer (flossy layer), ends of 60-80 cocoons are joined together and passing through a chambon type croissure and therepty traverse supported by bamboos are wound on a old type large reel. There is no in process control enforced to achieve quality coarse raw silk. The main objective is to produce maximum quantity of raw silk from cocoons, which is very coarse, rough, flat in size and inferior in quality.

Reeling performance and quality raw silk production depends mainly on cocoon characteristics, reeling machine, process parameters, reeler's skill and quality control (Sonwalkar *et al.*, 1990; Subhas *et al.*, 1994; Shrishail *et al.*, 1995). Qader *et al.* (2004) reported that variation of cocoon characteristics between the cocoons within a lot decide the quality and quantity raw silk production. Qader *et al.* (2004) opined that reeling performance and quality characteristics of coarse raw silk has been improved significantly reeled on fabricated improved Thai reeling machine than traditional Ghai reeling machine used in the rural areas. Hariraj *et al.* (1992) reported that raw silk produced in Cottage/domestic basin was better than Charka produced silk in India but this raw silk could not meet the standard of International market. Keeping this idea in mind, Bangladesh Sericulture Research and Training Institute developed an improved Thai reeling machine having standard mechanisms. The principles upon which the improved thai reeling machine works out are that cooking and reeling are done in the same basin at higher temperature, 20-40 ends of cocoon combine together to single silk thread passing through a porcelain guide and tavellata type of croissure wound on a small reel and re-reeling is done in a separate re-reeling machine on grand reel. On the other hand, the machine has a provision for reeling fine raw silk if the reeler desired. Shamachary (1986) reported more or less

similar mechanisms in improved Charka fabricated by CSRTI, Mysore India. Number of trials was conducted in the improved metallic Thai reeling machine laboratory level compared with traditional Ghai reeling machine and proved that machine is low. A provision is also made for reeling with the available quality of cocoons in all seasons of fine raw silk changing only porcelain guide if the Bangladesh, quality coarse raw silk may be produced in the improved Thai reeling machine. It was also found that a reeler could easily maintain all 4 ends of the reeling basin at a time. The cost of the reeling machine is about Tk. 15000 (fifteen thousand only) which is reasonable because the machine will be lasted about 20 years and at the same time produced raw silk may be sold at higher prices in the open market than traditional Ghai reeling machine.

MATERIALS AND METHODS

A set of improved Thai reeling machine has been fabricated having dual operative system manual driving and motor driving system (Figure 1). As a result, reeling capacity has been in evades and uniform speed of reeling has been assured. Beside a counting meter has been incorporated to know the amount of thread reeled out. The improved metallic Thai reeling machine has been incorporated with the following features:

Main Body Frame

The frame of the improved Thai reeling machine is made of mild steel rod as a result vital part of the machine helps to absorb all the vibrations during reeling. The design and construction of the reeling machine is very simple, thereby the cost of the reeler desired.

Reeling basin: The reeling basin is made of brass with an optimum dimension of 55cm x 35cm x 13cm to suit the four reeling ends. The basin has been no fixed to the machine frame with an outlet for drain out of water.

Porcelain Buttons

Porcelain buttons with larger holes are used in the machine and fixed to the steel clip holders.

Croissure Pulleys

Tavellette' type of croissure is maintained by means of croissure pulleys to facilitate smoother thread movement during reeling and also to maintain appropriate tension level. The distance between the top and bottom croissure pulley is about 12 cm and first pulley to porcelain buttons is about 8 cm at the height of 4 cm above the buttons.

Traverse Mechanism

A planetary traverse system is incorporated for diamond distribution of thread on the reel with cam and gear arrangements.

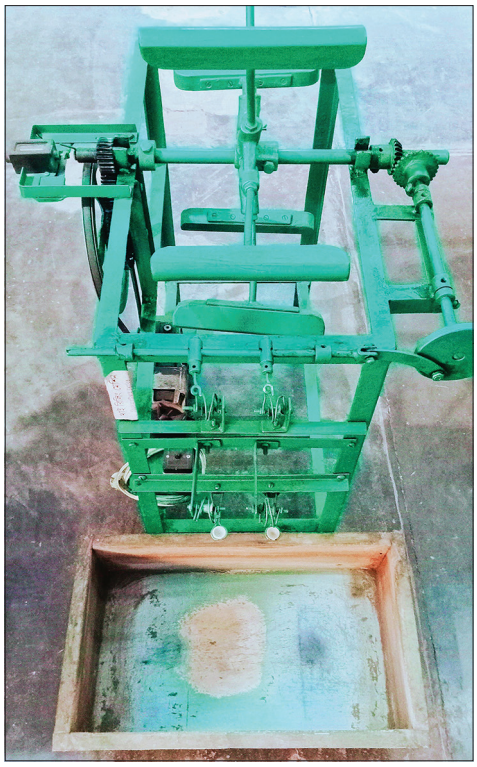

Figure 1: Improved Thai reeling machine

Reel

A wooden large reels with metallic holder and smooth surface has been used. The circumference of reels is about 165 cm.

Experimental Works

The reeling performance and quality raw silk produced in the laboratory by using multy voltine cocoons used improved Thai reeling machine and traditional Ghai reeling machine. The fabricated improved Thai reeling machine was installed at BSRTI lab.

The experiment was done by thirty samples (containing 1kg each) of green cocoons collected from silkworm section in four different seasons to determine the cocoon characteristics and reeling performance on improved Thai reeling machine. The study was conducted in four different silkworm rearing seasons viz. Chaita, Jaishta, Bhaduri and Agrahyani 2013-14 designated as S1, S2, S3 and S4 seasons respectively. The collected cocoon samples were dried in a hot air dryer following the methods of Subhas *et al.* (1994). After drying, cocoon samples were stored in storage racks for two days before reeling (Sonwalkar *et al.*, 1990). Fifty cocoons from each sample were reeled for single cocoon filament length, non-breakable filament and denier test in every season. The cocoon characteristics and reeling performances like defective cocoon (DFC) %, single cocoon weight (SCW), single shell weight (SSW), raw silk (%), raw silk recovery (%), reelability (%), filament length (FL), non-breakable filament (NBFL), single filament denier (SFD) and renditta were determined according to Sonwalkar (1988) and

Shamachary (1986). The raw silk produced from the study was tested for different quality parameters as per standard methods.

RESULT AND DISCUSSION

The data on cocoon characteristics are shown in Table 1. It may be observed from the table that the mean single cocoon weight, single shell weight and shell ratio were 1.76 g, 0.26 g and 16.22% respectively. It was also found that mean filament length, non-breakable filament length and single cocoon filament denier were 582.50 m, 374 m and 2.82 m respectively. The defective cocoon percentage was obtained 7.83% on the basis of total number of cocoons. From the results it is seen that all parameters studied in the laboratory and in different seasons varied due to variations of cocoon sizes. Sonwalkar *et al.* (1990), Hariraj *et al.* (1992) and Subhas *et al.* (1994) were reported similar results. The cocoons' reeling performance on the Deluxe Thai reeling machine (dual operating system) and the Traditional Ghai reeling machine is shown in Table 2, respectively. According to the reeling results, the mean renditta, raw silk recovery (%), reelability (%), and waste (%) were 9.74, 71.81%, 63.26%, and 5.36% in the improved Thai reeling machine (dual operating system), but, depending on the cocoon quality, they were 10.49, 69.98%, 62.49%, and 5.48% in the traditional Ghai. The specifications listed in this table for the improved Thai machine are all except 8 hours are needed to produce raw silk. From the Table 2 it was also observed that Improved Thai reeling machine shows better reeling performances compare to the Tradiational Ghai which correlated with the results of Sonwalkar *et al.* (1983) and Hariraj *et al.* (1992). In the present study variations of reelabillity % was observed between locations and within season, which are in agreement with Sonwalkar *et al.* (1983) who commented that it may be due to cocoon drying, cooking and reeling methods used. It was also observed from this Table 2 that mean production of raw silk cocoon reeling of multivoltine per 8 hours obtained about 0.920 kg in Improved Thai reeling machine and 0.862 kg in Traditional ghai. Hariraj *et al.* (1992) and Sonwalkar *et al.* (1990) noted that they obtained 1.14 kg and 1.00 kg raw silk cocoon in 8 hours reeling of multivoltine hybrid per improved Thai Reeling machine, which correlates with our findings. So, the reeling performance of multivoltine cocoon on BSRTI fabricated Improved reeling machine was satisfactory than existing Tradiotional Ghai reeling machine.

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The quality features of silk reeled on both the traditional Ghai reeling machine and the improved Thai reeling machine were displayed in Table 3. From the Table 3, it was observed that mean size (denier) and size deviation were found 22.43 and 1.98 in improved reeling machine and 24.35 and 2.97 in Traditional Ghai respectively which indicates that the reeler was able to maintain all 4 ends with required number of cocoons per end during the reeling period on Traditional Ghai reeling machine. It was also found that mean tenacity and Improved elongation

Table 1: Characteristics of cocoon

Location	Season	SCW (g)	SW (g)	SR (%)	FL (m)	NBFL (m)	SCFD (m)	DFC (%)
BSRTI lab, Rajshahi	S_1	1.71	0.29	16.50	580	370	2.95	8.10
	S_2	1.62	0.25	15.29	567	347	2.75	7.25
	S_3	1.63	0.26	16.31	573	345	2.74	7.88
	S_4	1.78	0.23	16.80	610	434	2.85	8.01
Mean		1.67	0.26	16.22	582.50	374	2.82	7.83

SCW-Single Cocoon Weight, SW-Shell Weight, SR-Shell Ratio, FL-Filament Length, NBFL-Non Breakable Filament Length, SCFD-Single Cocoon Filament Denier, DFC-Defective Cocoon

Table 2: Comparative reeling performances of improved Thai reeling machine (dual operating system) and Traditional Ghai reeling machine

Location	Parameters	Seasons	Renditta	Raw silk recovery (%)	Reelability (%)	Waste (%) on raw silk weight	Raw silk production/8 hrs/kg)	Avg. quantity of cocoons used/day/basin (kg)
BSRTI lab, Rajshahi	Improved Thai reeling machine (Dos)	S_1	9.22	71.77	65.60	5.23	0.965	7.13
		S_2	10.00	72.29	63.15	4.98	0.897	7.87
		S_3	9.77	69.96	62.80	5.46	0.849	7.34
		S_4	9.98	73.21	61.50	5.78	0.967	7.05
		Mean	9.74	71.81	63.26	5.36	0.920	7.35
	Traditional Ghai reeling machine	S_1	9.54	70.29	62.13	5.51	0.891	7.01
		S_2	11.71	69.96	59.81	4.98	0.847	7.12
		S_3	10.65	68.93	59.51	5.71	0.797	7.06
		S_4	10.06	69.97	68.51	5.72	0.911	6.98
		Mean	10.49	69.78	62.49	5.48	0.862	7.04

Table 3: Comparative quality characteristics of silk reeled on of improved Thai reeling machine and traditional Ghai reeling machine

Location	Parameters	Seasons	Avg. size (d)	size deviation	Maximum size deviation	Winding breaks/40 skeins	Tenacity (g/d)	Elongation
BSRTI lab, Rajshahi	Improved Thai reeling machine (Dos)	S_1	21.04	1.95	2.36	11	3.42	18.51
		S_2	22.88	2.11	2.47	14	3.11	17.89
		S_3	23.41	1.88	2.71	17	2.76	18.11
		S_4	22.43	1.96	2.34	10	3.21	20.41
		Mean	22.43	1.98	2.47	13.25	3.13	18.74
	Traditional Ghai reeling machine	S_1	22.98	2.81	3.87	16	3.13	17.90
		S_2	23.31	3.08	3.71	17	2.77	18.20
		S_3	24.35	2.97	3.11	19	2.61	20.43
		S_4	23.06	2.86	2.79	14	2.96	18.26
		Mean	23.42	2.93	3.33	16.5	2.87	18.70

percentage were 3.13 (g/d) and 18.74% reeling machine, whereas it was 2.61 (g/d) and 20.43% in Traditional Thai respectively. From the results, it is clearly observed that denier, size deviation, tenacity and elongation percentage of raw silk reeled on Improved Thai reeling machine showed better results compared to Traditional Ghai. Sonwalkar *et al.* (1990) and Hariraj *et al.* (1992) reported 3.13 (g/d) and 18.51% and 2.78 (g/d) and 18.70 tenacity and elongation %, respectively of raw silk reeled on Improved reeling machine which correlates with the present findings of raw silk reeled on fabricated improved Thai reeling machine. Qader *et al.* (2004) studied on the performance and quality of raw silk production with improved reeling machine and also suggested to use it for better production.

From the above discussion it is suggested that the BSRTI fabricated Improved Thai reeling machine is an improved reeling appliance which can use commercially to get high quality raw silk production through all seasons in Bangladesh.

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