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Effect of Cocoon Parameters of Silkworm as Influenced by Different Spacing in Mulberry, *Morus alba*. L

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Rearing of silkworm is an art and science; popularly known as sericulture and agro based cottage industries provide employment, to million in China, India, Korea and Vietnam. Investigation were carried out to know the effect of cocoon parameters of silkworm as influenced by different spacing in mulberry *morus alba*. L. Maximum cocoon weight and cocoon yield was recorded in 9×3 ft spacing (19.84 g/ten cocoon and 0.69 kg cocoon yield/400 worms in first rearing and 17.72 g/ten cocoon and 0.41 kg cocoon yield/ 400 worms in second rearing. The increase in cocoon weight is mainly due to increase in the larval weight and better nutrition. Shell weight also differed significantly between the treatments wherein maximum shell weight was recorded in 9×3 ft spacing (3.72 g/10 shells in first rearing and 3.14g/10 shells in second rearing). However, lowest shell weight was recorded in 3×3 ft spacing (2.70 g/10 shells in first rearing and 2.11 g/10 shells in second rearing). Increased filament length might be attributed to increased shell weight and increase in filament weight increases to increased filament length. Shell ratio differed significantly between treatments and maximum shell ratio was recorded in 9×3 ft spacing (18.72 per cent in first rearing and 16.17 per cent in second rearing). However, denier was found to be highest in 9×3 ft spacing (2.87 in first rearing and 2.53 in second rearing) and lowest was recorded in 3×3 ft spacing (2.01 in first rearing and 1.96 in second rearing). This might have resulted because of the better environment, nutrition and contributory factors expressed in rearing.

Keywords: Spacing, mulberry, Silkworm, cocoon.

In India, the major silk producing traditional states are Karnataka, Andhra Pradesh, Tamil Nadu, West Bengal and Jammu and Kashmir. In Karnataka, the major districts producing silk are Chikkaballapur (1253.99 MT), Kolar (1499.03 MT), Ramanagara (1665.98 MT) and Mandya (1597.09 MT) (Anonymous, 2012 b). In these districts, the cocoon crop vary according to, method of mulberry cultivation, package of practices adopted in both rainfed and irrigated condition and silkworm rearing house. Thus, quality of mulberry leaf plays a major role in successful cocoon production. Further, the quality of mulberry leaf depends on the variety of mulberry, soil type, methods of cultivation and the inputs used.

In this context, it was thought necessary to investigate the suitable planting system, which can maximize the leaf yield, quality of mulberry on cocoon yield.

MATERIALS AND METHODS

Investigations were carried out to know the "The evaluation of rearing performance of silkworm as influenced by different spacing in mulberry *morus alba*. l.". The experiments were

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conducted in University of Agricultural Sciences, Bengaluru, College of Sericulture, Chintamani during the year 2013-14.

Silkworm rearing

Disinfection of rearing room

Before commencement of rearing the silkworm rearing room and equipments were washed with water, then disinfected using 0.2 % Decol solution at the rate of 2 litres per m^2 plinth area.

Choice of silkworm breed

The commercial cross breed PM × CSR_2 was used for the study. The disease free layings (DFLs) were procured from NSSO grainage, CSB, Chintamani.

Incubation of dfls

Five DFLs were kept on paraffin paper in plastic trays and covered with another paraffin paper. The optimum temperature and relative humidity was maintained by keeping moist foam rubber strips all around the egg sheets. The eggs were subjected to black boxing for 24hrs at blue egg stage. After which the eggs were exposed to diffused light on the expected day of hatching to obtain uniform hatching.

Brushing

The newly hatched larvae were provided with chopped mulberry leaves of required quantity and quality. After 30 minutes of feeding, the larvae were transferred on to the plastic trays along with the mulberry leaves having paraffin paper at the bottom and wet foam rubber strips provided all round.

Silkworm rearing

Mass rearing was done in plastic tray from brushing till third moult. The worms were reared by feeding three times a day (8.30 A.M., 12.30 P.M. and 6.30 P.M). Bed cleaning was done once twice and thrice during I, II, III instars, respectively. Whereas, daily once during IV and V instar. During rearing, optimum spacing was provided according to the age of silkworm, after each bed cleaning. Lime powder was dusted on silkworm before settling for moult so as to keep the bed dry and facilitate easy moulting in each moult a bed disinfection with Vijetha was practiced. The rearing trays were covered with uzi fly proof nylon nets. After III instar, hundred worms were allocated for each replication.

Feeding

The mulberry leaves were harvested during cooler hours of the day from mulberry plots with different spacings. The leaves of respective spacing were fed to worms separately. Leaves were provided to chawki worms whereas whole shoot feeding was followed for late age silkworm rearing.

Mounting and harvesting

The ripe worms were handpicked and mounted on bamboo mountage as per treatment and cocoons were harvested manually on 4^{th} day of mounting.

Observation recorded

Cocoon weight (g)

Ten cocoons were randomly picked from each replication of every treatment and weight was recorded on the fifth day of mounting and average weight was calculated.

Cocoon yield (kg)

Cocoon yield per 100 worms reared in each replication was calculated to get cocoon yield.

Shell weight (g)

After taking cocoon weight cocoons were cut open and ten empty shells were weighed for each replication and treatment.

Silk filament length (m)

Five cocoons per replication were selected and each cocoon was reeled using eupprovette and silk filament length was recorded. Filament length was calculated by the formula,

$L = R \times 1.125m$

Where, in

L = Length of the silk filament (m).

R = Number of revolutions.

1.125m = Circumference of the euprovette.

Silk filament weight (g)

The reeled silk filament from each cocoon was dried, by keeping in hot air oven at 80^0 C and weight was recorded using electronic balance.

Shell ratio (%)

Shell ratio was calculated by using the formula

$$\text{Shell ratio} = \frac{\text{Shell weight (g)}}{\text{Whole cocoon weight (g)}} \times 100$$

Denier

Denier was found out by using the formula,

$$\text{Denier} = \frac{\text{Weight of silk filament (g)}}{\text{Length of silk filament (m)}} \times 9000$$

RESULTS AND DISCUSSION

Rearing parameters

Commercial characters of cocoons

Maximum cocoon weight and cocoon yield was recorded in 9×3 ft spacing (19.84 g/ten cocoon and 0.69 kg cocoon yield/400 worms in first rearing and 17.72 g/ten cocoon and 0.41 kg cocoon yield/400 worms in second rearing. However significantly lowest was recorded in 3×3 ft spacing [16.23 g/ten cocoon and 0.48 kg cocoon yield/400 worms in first rearing 13.43 g/ten cocoon and 0.41 kg cocoon yield/400 worms in second rearing. The increase in cocoon weight is mainly due to increase in the larval weight and better nutrition. The cocoon yield was recorded highest in first rearing compare to second rearing this is mainly due to disease incidence in second rearing, while there was no disease incidence in first rearing. These findings are in accordance with Rahman *et al*. (1999).

Shell weight also differed significantly between the treatments wherein maximum shell weight was recorded in 9×3 ft spacing (3.72 g/10 shells in first rearing and 3.14g/10 shells in second rearing). However, lowest shell weight was recorded in 3×3 ft spacing (2.70 g/10 shells in first rearing and 2.11 g/10 shells in second rearing). These results differed from findings of Rao *et al*, (2000).

Silk filament length and weight was found to be highest in 9×3 ft spacing (790.52 m and 0.25 g respectively in first rearing and 751.34 m and 0.21 g respectively in second rearing), and least was recorded in 3×3 ft spacing (670.45 m and 0.15 g respectively in first rearing and 630.34 m, 0.21 g respectively in second rearing). Increased filament length might be attributed to increased shell weight and increase in filament weight increases to increased filament length. These results are in conformity with that of Ghosh *et al*. (2009) who

Table 1. Impact of different spacings in mulberry on cocoon parameters of silkworms (first rearing-October 2013)

Treatments	Weight of ten cocoons (g)	Cocoon yield (kg/400worms)	Weight of 10 cocoon shell (g)	Single cocoon silk filament length (m)	Single cocoon filament weight (g)	Shell ratio (%)	Denier
T1-9×3 ft. spacing	19.84a	0.69 a	3.72 a	790.52 a	0.25 a	18.72 a	2.87 a
T2-6×3 ft. spacing	17.23	0.58	3.01	700.57	0.17	17.48	2.21
T3-(6+3) ×3 ft. spacing	18.53b	0.64 b	3.29 b	763.13 b	0.23 b	17.75 b	2.74 b
T4-3×3 ft. spacing	16.23	0.48	2.70	670.45	0.15	16.64	2.01
T5-(5+3) ×2 ft. spacing	18.12b	0.61	3.19	723.32	0.21	17.61	2.61
F- test	*	*	*	*	*	*	*
SE.m ±	0.159	0.013	0.011	1.465	0.006	0.056	0.067
CD at 5%	0.480	0.039	0.033	4.416	0.017	0.169	0.203

Table 2. Impact of different spacings in mulberry on cocoon parameters of silkworms (second rearing-April 2014)

Treatments	Weight of ten cocoons (g)	Cocoon yield (kg/400worms)	Weight of 10 cocoon shell (g)	Single cocoon silk filament length (m)	Single cocoon filament weight (g)	Shell ratio (%)	Denier
T1-9×3 ft. spacing	17.72 a	0.65 a	3.14 a	751.34 a	0.21 a	16.17 a	2.53 a
T2-6×3 ft. spacing	15.86	0.53	2.83	692.42	0.15	15.02	2.14
T3-(6+3) ×3 ft. spacing	15.17	0.55	2.93	698.12	0.16b	15.13	2.43
T4-3×3 ft. spacing	13.43	0.41	2.11	630.34	0.12	13.43	1.96
T5-(5+3) ×2 ft. spacing	16.93 b	0.59 b	3.07 b	713.53 b	0.18 b	15.79 b	2.49 b
F. test	*	*	*	*	*	*	*
SE.m ±	0.040	0.021	0.016	1.246	0.015	0.037	0.019
CD at 5%	0.122	0.062	0.048	3.754	0.047	0.111	0.058

observed that cocoon yield/100dfls, Shell per cent, Filament length(m) and Reelability (%) were significantly superior in paired row plantation [(150+90)×60 cm].

Shell ratio differed significantly between treatments and maximum shell ratio was recorded in 9×3 ft spacing (18.72 per cent in first rearing and 16.17 per cent in second rearing). However, minimum shell ratio was recorded in 3×3ft spacing (15.02 % in first rearing and 13.43 per cent in second rearing). Similar results are also observed by Ramakanth *et al*. (2001)

However, denier was found to be highest in 9×3 ft spacing (2.87 in first rearing and 2.53 in second rearing) and lowest was recorded in 3×3 ft spacing (2.01 in first rearing and 1.96 in second rearing). This might have resulted because of the better environment, nutrition and contributory factors expressed in rearing.

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