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An impact on *Bombyx mori* in Food Rationing – An Economic Analysis

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Abstract

Sericulture is an Agroindustry it is considered as a growing agriculture enterprise. The present study mainly focuses on the sericulture silkworm rearing practices, requirements and its profit. Certain requirements like feeding mulberry leaves for silkworm during the rearing process. The quality is based on the age and probability of worm's intake. The feeding time should be followed consistently the more appropriate. According to the financial analysis, as per the benefit cost ratio it is greater than 1 i.e., Sericulture considered as profitable. The market price is decided by quality of cocoon. The quality of cocoon based on hardness, width and brightness of cocoon.

***Key words*:** Sericulture, silkworm rearing, cocoons, Feed rationing, BCR

The silkworm, *Bombyx mori*, plays a crucial role in the sericulture industry, producing high-quality silk that supports livelihoods, particularly in rural economies. However, food rationing—whether due to economic constraints, resource limitations, or scientific optimization of feeding—significantly affects its growth, development, and silk yield [1]. Analyzing the economic implications of food rationing in *Bombyx mori* is essential for understanding how optimized feeding strategies can enhance productivity while ensuring cost-effectiveness in silk production. Silk production is a vital agro-based industry that provides employment and contributes to national economies, especially in countries like China, India, and Japan. The success of sericulture depends on the efficient rearing of silkworms, which are highly sensitive to their diet. Mulberry (*Morus spp*.) leaves serve as the primary and exclusive food source for *Bombyx mori*, and the quantity and quality of leaves provided significantly influence cocoon quality, silk yield, and overall economic returns [2].

Food rationing in silkworm rearing refers to the practice of regulating and optimizing the quantity of mulberry leaves provided at different larval stages. It is often implemented to reduce feeding costs, minimize leaf wastage, and improve rearing efficiency [3]. However, excessive rationing can lead to undernourishment, poor cocoon quality, and economic losses. Hence, a balanced approach to food rationing is critical for maintaining silk productivity while ensuring sustainable resource utilization. The economic analysis of food rationing in *Bombyx mori* involves assessing how different feeding regimes impact production costs, cocoon yield, silk filament quality, and overall profitability. Key economic factors include:

Cost of mulberry cultivation: Mulberry leaf production requires labor, fertilizers, irrigation, and land resources, all of which contribute to sericulture expenses. Optimizing leaf use through rationing can reduce these costs.

Cocoon yield and quality: Any reduction in the quantity of feed can directly influence cocoon weight, silk percentage, and filament length, affecting market value.

Labor and rearing costs: Efficient feeding practices can streamline silkworm management, reducing labor costs associated with leaf collection and feeding.

Environmental and sustainability aspects: Reducing excess leaf feeding contributes to sustainable resource utilization, minimizing waste and improving ecological balance.

A comprehensive economic analysis of food rationing in *Bombyx mori* is essential for balancing cost reduction with productivity gains. By evaluating feeding strategies from an economic perspective, sericulture farmers can adopt more profitable and sustainable practices. This study aims to explore the impact of food rationing on silkworm growth, cocoon production, and financial returns, offering valuable insights for policymakers, researchers, and sericulture practitioners [4].

Thus, understanding the economic consequences of food rationing in *Bombyx mori* rearing can help in developing cost-effective and scientifically optimized feeding strategies, ensuring long-term sustainability and profitability in the silk industry.

The entrepreneurial demand known as rearing of silkworm apart from that the demand for entrepreneurial traits in the recent times Sericulture Rearing getting much familiar. Sericulture is rearing of silkworm for silk production by feeding mulberry as feed. Silk is called as queen of textiles due to its

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elegance, softness, durability and glittering luster. Sericulture comprises of cultivation of mulberry, which is called Moriculture, reeling of silk from cocoon and other related activities. Major silk producing countries in world China (emerging of new silk industries, India, Uzbekistan. Major silk consuming countries are USA, Italy, Japan, India. In year 2020 China produced 53,359 metric tonnes which stands 1st country in silk production in world whereas India stands 2nd in world silk production which is 33,770 metric tonnes [5]. In year 2020 – 2021 silk export by India earns about Rs. 1418.97 crore in which mulberry accounts 70.71% which is 23,860 metric tonnes. In India majorly silk producing states are Karnataka, Andhra Pradesh, Tamil Nadu, Telangana, Maharashtra and West Bengal. In Tamil Nadu 1,834 metric tonnes of raw silks produced during 2020 – 2021 in which 1,754 metric tonnes are mulberry silkworm [6]. Among the majorly producing areas in Tamil Nadu the following 4 districts such as Kanchipuram, Arani, Thirubuvanam, Salem venpattudhoties are approved with Geographical indication tag which denotes the need and importance and future demand of sericulture.

Table 1 Sericulture production scenario among the world

Countries	2015	2016	2017	2018	2019	2020
Bangladesh	44	44	41	41	41	41
Brazil	600	650	600	650	469	377
Bulgaria	8	9	10	10	10	10
China	170000	158400	142000	120000	68600	53359
Colombia	0.5	0	0	0	0.5	0.5
Egypt	0.83	1.2	1.1	1.25	1.5	1.5
India	28523	30348	31906	35261	35820	33770
Indonesia	8	4	2.5	2.5	2.5	2.5
Iran	120	125	120	110	227	270
Japan	30	32	20	20	16	16
Madagascar	5	6	7	7	7.5	7.5
North Korea	350	365	365	350	370	370
Romania	0	0	0	0	0.5	0.5
Philippines	1.2	1.82	1.5	2	2	2
South Korea	1	1	1	1	1	1
Syria	0.3	0.25	0.25	0.25	0.5	0.5
Thailand	698	712	680	680	700	700
Tunisia	3	2	2	2	2	2
Turkey	30	32	30	30	5	5
Uganda	0	0	0	0	3.1	3
Uzbenkistan	1200	1256	1200	1800	2037	2037
Vietnam	450	523	520	680	795	969
Total	202073	192512	177507	159648	109111	91945

Source: International Sericulture Commission

The (Table 1) revels that total quantity production among the world 91945 MT. India stands the II largest country after China in total production with 33770. Compare to 2015 (202073 MT production) 2020 met a drastic decrease in production since the demand for sericulture production is increasing, tends to increase the need for increase in production of sericulture. This implies the probability of sustainability for sericulture. Asia is the major producer of silk in the world, which contributes 95% of total global output. In Asia China and India are the leading producers of silk in terms of production to produce a huge amount of silk. India stands second in silk production and also one of the largest consumer countries in the world. India has a strong traditional and cultural bond over silk. India Mulberry silk producing states in India are Karnataka, Andhra Pradesh, Tamil Nadu, Jammu & Kashmir and West Bengal. Non mulberry silk producing Jharkhand, Chhattisgarh, Orissa and North eastern states.

MATERIALS AND METHODS

The rearing process was conducted at sericulture unit of Kalasalingam academy of research and education, Alagapuri, Virudhunagar district, Tamil Nadu. {9.6340 N, 77.7986 E}. The research study comprised of two feed per day from 3rd instar to till spinning stage. The worms with 30 dfl were reared.

The worms were reared at recommended temperature and relative humidity during chawki stage. By successful completion of chawki stage with two instars. The worms were now to commercial rearing. Feeding mulberry leaves for silkworm during the rearing process the quantity are based on the age and probability of worm's intake. Late age rearing was adapted after2nd moulting, whereas young leaves were feeded. Feeding practiced twice a day. Adopting young leaves of mulberry as a feed for early late age rearing. The feeding time denoted during the starting of feed should followed till the last instar for quality cocoon.

Table 2 Equipment's required

Equipment	Uses
Precautionary measures	
Coconut leaves	To maintain heat inside the unit
Lime powder	To remove moisture in the sericulture bed
Disinfectant (asthra, bleach, uzinassh)	To keep room disease free
Grease	To prevent sericulture bed from ants
Gunny bags	Helps to reduce temperature
Rearing unit equipment	
Thermometer	Measure temperature
Hygrometer	Measure humidity
Sprayer	Applying water in case of high temperature
Netrika	Mountage for cocoon formation
Basket	To collect mulberry
News paper	Provide base for rearing worms
Ropes	Provide base for bed

Wooden poles	Provide framework to bed Mulberry
Fertilizers (urea)	Improve foliage growth
Manures (FYM)	Add organic matter to the soil
Mother plant	Provide cuttings for nursery
Pruning shears	Cut mulberry leaves from plant

Feeding schedule

Table 3 Feed frequency and timing

Feed frequency	Time of feeding
1 feed	9:30 am
2 feed	4:00 pm

The above table reveals that feeding time should be maintain regularly throughout the lifetime of the silkworm (i.e., II instar – V instar) feed was given two times a day.

Mulberry garden

Mulberry MR 2 variety with spacing 3x3 meter is grown and used as feed for rearing the worms in this present study.

RESULTS AND DISCUSSION

Fourteen economic traits were followed for pretending evaluation. The data on feed composition ratio in food rationing was recorded and the significance found by doubling the food on each instar the length of worms is noted. Which directly proportional for quality of cocoon is decided. In sericulture the paramount and important factor is feed ration which has a direct impact on growth and development of cocoon and silk yield and it determined the cost involvement and market price i.e. profit of silkworm rearing. Sericulture an on given 2 feed per day for 10,500 worms at the rate of 45 kg feed at 3rd instar, 155 kg feed at 4th instar and 455 kg before cocoon formation yields about 19.150 in which pure cocoon weights about 16.780 kg and stained cocoon weights 2.370kg. After each moulting no feed is given for one day were as feeding starts for second day. The result on each instar was recorded denotes the feed ration importance with maximum length 6.7 cm. From observed data the feed ration gradually increasing with increase in length and weight of the worms which yields maximum weight of cocoon. IV and V instar are very significant in yield which result is profitable maximum size, length and weight. Worms in starvation stating resulted in poor yield and poor cocoon characteristics and emphasized on providing quality mulberry leaves in a proper quantity to get good cocoon crop. At larval stage, larval duration varied significantly in terms of IV and V instars. The post cocoon parameters for the quality cocoon production is based on the different feeding frequencies varies based on larval stage [7-10].

The results demonstrate that providing a balanced and sufficient quantity of quality mulberry leaves ensures optimal growth, development, and profitability in silkworm rearing. Conversely, feed starvation negatively affects yield and cocoon characteristics. The observed data confirm that proper feeding schedules directly impact larval length, weight, and cocoon production, emphasizing the importance of strategic feed management in sericulture [11-13].

In present study, feeding frequency among different larval stage marked significant difference for weight of mature larva. However, there was a marked difference among III, IV and V instar, since the intake of feed during V instar was higher than third and fourth instar. This may be because higher frequency of feed leads to robust growth and development and the competition for the food is also less. The investigation reported that three to four times feeding per day resulted in higher larval weight, lower-level mortality and shorter larval duration than two or one time feeding per day.

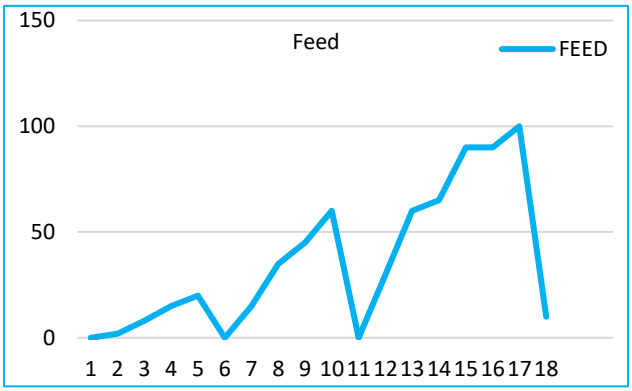

Fig 5 Feeding frequency

Table 4 Feeding frequency of mulberry leaves

Days	Feed (kg)
1	0
2	2
3	8
4	15
5	20
6	0 (moulting)
7	15
8	35
9	45
10	60
11	0 (moulting)
12	30
13	60
14	65
15	90
16	90
17	100
18	10 (cover feed)

The above table reveals that the per day requirements, feeding capacity of mulberry leaves to silkworm, the feed with 645kg of mulberry leaves in total was given for the total of 10,500 larvae. The change in quantity of feed differs based on the number of feed given. The feed was given to total of 10,500 larvae with 645 kg of mulberry leaves. Feed is denoted. The quantity differs based on the number of moulting undergoes after each instar. the feed ration ratio tends to almost 5 times higher than 3rd instar. This implies during 5th instar the quantity ratio with silkworm denotes the size and weight measurement for quality cocoon production.

Table 5 Financial analysis

S. No.	Particulars	Expenditure
1.	Unit rent	1000
2.	Mulberry cost	1935
3.	Disinfectant (+ lime)	570
4.	DFL	780
5.	Netrika	1000
6.	Transportation	250
	Grant total	5535

Profit analysis

Total yield – 16.57 kg
Price – 400/kg

Total profit = 400x 16.5 = 6600

$$BCR = \frac{Net\ returns}{Total\ expenditure}$$

$$= \frac{6600}{5535} = 1.2$$

Since the BCR value is greater than 0 i, e (1.2) the revenue obtained is profitable.

Table 6 Growth parameters of silkworm

Instar	Length of worm (cm) (Average)	Width of worm (cm) (Average)	Feed given (In kg)	Weight of worm (Ing) Average
3	0.94	0.1	45	0.5
4	2.5	0.5	155	1.4
5	6.7	1.59	445	3.64

The data depicted in (Table 6) reveals that increase in feed increases the length and width of the silkworm which simultaneously increase the cocoon weight. Based on feed weight increases weight denote the width of cocoon. The quality of cocoon is based on width which simultaneously proportional to hardness of the cocoon hence the cocoon hardness denotes the market price [14-15].

CONCLUSION

In food rationing of silkworms generally they are voracious eaters of mulberry leaves during its larval stages and around 80 per cent of leaf is consumed in last two instars. The post cocoon parameters for the quality cocoon production is based on the different feeding frequencies varies based on larval stage decide the profitable cocoon production with BCR 1.2 The uneven growth of larva or poor coon quality changes arise when the proper feed is not provided to the seri worms because the quality and quantity of feed act as an important role in growth and development of silkworm, which influences the expression of cocoon productivity. The intake of food during total larval life is also reflected by the weight mature larvae. The observed data obtained by providing two feedings in a day as experimental. It is clearing observed that Mulberry feeding play major role in cocoon production process. Providing three feeding in day tends to increase worm size and length which results in good cocoon in terms of quality and quantity. Also yields market quality for increased profit. In addition, providing proper aeration between worms reduces the based quality and infection increase size in cocoon. The study highlights food rationing in silkworms rearing to get better yield in terms of profitable quality and quantity cocoon.

LITERATURE CITED

1. Gangwar SK. 2013. Study on chlorophyll content, soluble protein, carbohydrates and moisture content of *Morus alba*. Linn. *International Journal of Science and Nature* 4(1): 130-136.
2. Sharma A, Sharma P, Thakur J, Murali S, Devi A, Singh S. 2018. Effect of food rationing on quantitative parameters of silkworm *Bombyx mori* L. *International Journal of Agriculture Science* 10: 1-4.
3. Vikalpsharma. 2019. Economic analysis of silkworm rearing and cocoon production in Bilaspur district of Himachal Pradesh. *Economic Affairs* 64: 1-9.
4. Abbas J. 2019. Rearing of silkworm (*Bombyx mori*) to produce silk. *Technology Times* 1: 3-8.
5. Balasundaram D, Selvi S, Mathivanan V. 2008. Studies on comparative feed efficacy of mulberry leaves MR2 and MR2 treated with vitamin C on *Bombyx mori* (L.) (Lepidoptera: Bombycidae) in relation to larval parameters. *Current Sciences* 12(2): 677-682.
6. The National-Silk-Policy-2020. Central Silk Board, Bengaluru. Retrieved from:https://csb.gov.in/wp-content/uploads/2021/02/National-Silk-Policy-2020.pdf.Published 2020.
7. Thangapandiyan S, Dharanipriya R. 2019. Comparative study of nutritional and economical parameters of silkworm (*Bombyx mori*) treated with silver nanoparticles and Spirulina. *JoBAZ* 80: 21. https://doi.org/10.1186/s41936-019-0096-0
8. Yilmaz S, Ergün S, Yigit M, Yilmaz E, Ahmadifar E. 2020. Dietary supplementation of black mulberry (*Morus nigra*) syrup improves the growth performance, innate immune response, antioxidant status, gene expression responses, and disease resistance of Nile tilapia (Oreochromisniloticus). *Fish Shellfish Immunology* 107: 211-217.
9. Cappellozza S, Casartelli M, Sandrelli F, Saviane A, Tettaman G. 2023. Silkworm and silk traditional and innovative applications. *Insects* 13: 1016.
10. Sengupta K, Singh BD, Mustafi JC. 1972. Nutrition of silkworm, *Bombyx mori* (L). Studies on the enrichment of mulberry leaf with various sugars, proteins, amino acids and vitamins for vigorous growth of the worm and increased cocoon crop protection. *Indian Journal of Sericulture* 11(1): 11-27.
11. Rahamathulla VK, Mathur VB, Geethadevi RG. 2004. Growth and dietary efficiency of mulberry silkworm (*Bombyx mori*) under various nutritional and environmental stress conditions. *Philippines Journal of Science* 133(1): 39-43.
12. Mathavan S, Krishnan JM. 1976. Effects of ration levels and restriction of feeding durations on food utilization in *Danaus chrysippus* (Lepidoptera: Daniadae). *Entomologia Experimentalis et Applicata* 19: 155-162.
13. Ganesh Prabu P, Selvi S, Balasundaram D, Pradhap M, Vivekananthan T, Mathivanan V. 2012. Effect of food supplementation with silver nanoparticles (AgNps) on feed efficacy of silkworm, *Bombyx mori* (L.) (Lepidoptera: Bombycidae*). International Research Journal of Biological Sciences* 2(2): 60-67.
14. Jayaram H, Mahadevegowda L. G, Boregowda M. H. 2024. Seri-Entrepreneurship: Current Status and Potential Opportunities. *Current Agriculture Research Journal* 2024; 12(1): 385-399.
15. Hăbeanu M, Gheorghe A, Mihalcea T. 2023. Silkworm *Bombyx mori*—Sustainability and economic opportunity, particularly for Romania. *Agriculture* 13(6):1209.