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Constraints faced in the Adoption of Technologies by Chawki Rearing Centre Entrepreneurs

Basavaiah[1] and Chandrashekar S. Kallimani[2]

ABSTRACT

Chawki Rearing Centres (CRCs) act as backbone of silkworm rearing activity. The study was conducted in 100 CRCs of six traditional sericultural districts of Karnataka with the objective of understanding the constraints faced by CRC entrepreneurs in adoption of recommended technologies. Through pilot survey, 30 constraints were identified and they were ranked based on Garrett score. While shortage of farm laborers, scarcity of irrigation water, lack of technical guidance in pest and disease management, difficulty in harvesting leaf and shootlet alternatively and high labor wages were the major constraints in adoption of mulberry leaf production technologies, inadequate rearing space, scarcity of skilled workers, lack of space for supporting activities, lack of technical guidance to diagnose diseases and high wages of skilled workers were the major constraints in adoption of silkworm rearing technologies. Measures to be taken to overcome these constraints are suggested.

Keywords*: Chawki rearing centre; Constraints; Karnataka; Mulberry sericulture; Entrepreneur*

INTRODUCTION

Mulberry sericulture involves many interlinked activities such as cultivation of mulberry for leaf, silkworm rearing by feeding mulberry leaf for cocoon and reeling of cocoons for raw silk productions. The success of silkworm rearing largely depends on the quality of young age silkworms. The young silkworms are popularly called *'chawki'* and the specialized centers with exclusive facilities for rearing silkworms up to 2nd moult are termed as 'Chawki Rearing Centers' (CRCs). The concept of rearing chawki worms in CRCs and rearing only adult worms at farmers' level is being popularized by both Central Silk Board (CSB) and Department of sericulture of different states through various schemes from the past four decades (Anonymous, 2019). Further, appropriate and economically viable technologies/practices on chawki rearing have been recommended by Central Sericulture Research and Training Institute, Mysore (Sivaprasad et al., 2015) Karnataka State Sericulture Research and Development Institute, Bangalore (Radhakrishna et al.

[1]Department of Studies in Sericulture Science, University of Mysore, Manasagangothri, Mysuru, India and [2] Krishi Vigyan Kendra, University of Agricultural Sciences, Bengaluru, Chamarajanagara, India.

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2004). As a result, CRC activity has become a successful entrepreneurship especially in Karnataka. Chawki rearing concept has contributed remarkably, by increasing the national average of cocoon productivity from 55kg to 65 kg in the past decade (Shashindran Nair and Mishra, 2018). But, the studies related to the adoption of technologies by the CRCs and constraints faced by CRC entrepreneurs are limited, except for a few detailed studies (Vijayakumari & Rajan, 2005). The present study was conducted with the objective of understanding the constraints faced by entrepreneurs of the said CRCs, in adopting the technologies related to mulberry leaf production exclusively for chawki and rearing as well as marketing of chawki worms.

METHODOLOGY

The present study was conducted in CRCs of six traditional sericultural districts of Karnataka namely, Bengaluru rural, Chikkaballapura, Kolar, Mandya, Mysore and Ramanagara. These districts contribute nearly 81 % of raw silk production of the state and include nearly 72 % of CRCs functioning in Karnataka. Altogether, 100 respondents (CRC entrepreneurs) were selected from all the districts, using simple random sampling technique based on the data provided by state department of sericulture and institutions of Central Silk Board. The CRC entrepreneurs were categorized into four categories based on their brushing capacity (BC) of Disease free layings (Dfls) per annum as follows: CRCs with 0.8 to 2.40 lakh Dfls/yr as BC I; 2.41 to 4.00 lakh Dfls/yr as BC II; 4.10 to 5.60 lakh Dfls/yr as BC III and 5.61 to 13.60 lakh Dfls/yr as BC IV. In all, fourteen constraints in the adoption of technologies related to mulberry leaf production were identified. Further, these were classified in to input, technical and economic constraints. Similarly, sixteen constraints identified in the adoption of technologies related silkworm rearing and marketing of chawki. These constraints were also classified in to infrastructure, extension, socio-economic and marketing constraints.

The respondents were asked to rank the identified 14 constraints related to the adoption of mulberry leaf production technologies and 16 identified constraints related to rearing and marketing of chawki silkworm technologies. Garrett ranking method (Garrett, 1981) was used to analyze the constraints. The ranks given by the respondents were converted into percent position by using the following formula:

$$\text{Per cent position} = \frac{100 \text{ X } (Rij - 0.5)}{Nj}$$

Where,

Rij = Ranks given to the i^{th} constraint by the j^{th} CRC entrepreneur

Nj = Number of constraints ranked by the j^{th} CRC entrepreneur.

By referring to the Garrett's table, the per cent positions estimated were converted into scores. Thus, for each constraint the scores of the various CRC entrepreneurs were added and the mean values were calculated. The mean values were arranged in descending order. The constraint with the highest mean value was considered as the most important

one and the others followed in that order. The Garrett score and Rank were recorded brushing capacity wise. The average score of four categories of CRCs was considered for overall ranking.

FINDINGS AND DISCUSSION

Two main activities of CRCs are production of mulberry leaf for feeding to the young silkworms and rearing of silkworms up to 2nd moult. After 2nd moult the young worms will be sold to the sericulturists who rear the late age worms and produce cocoons. So, the constraints related to the adoption of mulberry leaf production technologies/practices and silkworm rearing technologies/practices are dealt separately.

Constraints related to Mulberry Leaf Production

The Garrett score and rank of 14 constraints in the adoption of recommended technologies/practices related to mulberry leaf production faced by the entrepreneurs of four categories of CRCs along with their average Garett score and rank are presented in Table 1.

Input Constraints

The input constraint 'shortage of farm laborers at times' with the highest Garrett score (71.8) and first rank was found as a major constraint among the 14 constraints in all the four categories of CRCs. Further,it was the topmost constraint among the input constraints. Dearth of farm laborers is a very serious problem in farming sector now-a-days. As chawki mulberry leaf production is a more intensive farm activity requiring large number of manual laborers for application of manures, inter-cultivation, harvesting of leaf etc. at regular short intervals, it had become a very serious constraint. CRC entrepreneurs have to resolve this constraint by proper planning of activities and mechanization of farming activities. Second most important constraint was 'scarcity of irrigation water'. Most of the CRCs of study area belong to drought prone areas /dry zone and face the problem of irrigation water scarcity especially during summer. Drip irrigation system is recommended for mulberry and government is also encouraging to adopt this system by providing subsidy. Though majority of the CRCs have adopted drip irrigation system, their bore wells dry up during summer particularly in Kolar, Chikkaballapura, Bengaluru rural and part of Ramanagara districts. Further, due to the same problem demand for chawki also decreases. To some extent, CRCs overcome this problem by reducing their brushing capacity and also by marketing their chawki in other districts.

Other two input constraints viz. insufficient FYM at disposal and non-availability of IPM and IDM materials with average garrett scores 53.9 and 51.6 and corresponding fourth and seventh ranks respectively, were serious constraints in some CRCs. Comparatively, the FYM constraint was found more serious in CRCs of BC II category. As per the recommendation, 40 MT/ha of FYM should be applied. Though, CRC entrepreneurs have high knowledge level (94%) and also adoption level (84%) of organic

Table 1.
Garrett Score (GS) and Rank (R) of Constraints faced by the CRC Entrepreneurs in the Adoption of Mulberry Leaf Production Technologies

Sl. No.	Constraints	Brushing capacity (BC) - wise GS and R of CRCs								Average of GS & R of CRCs	
		BC I (n=44)		BC II (n=32)		BC III (n=15)		BC IV (n=9)			
		GS	R	GS	R	GS	R	GS	R	GS	R
	Input constraints										
1	Shortage of farm labors at times	71.7	I	70.3	I	69.7	I	75.4	I	71.8	I
2	Scarcity of irrigation water	68.6	II	67.8	II	66.0	II	62.0	III	66.1	II
3	Insufficient FYM at disposal	56.8	VI	55.1	VII	55.9	VI	56.6	V	56.1	VI
4	Non availability of IPM/IDM materials	56.4	VII	50.0	XI	54.5	VII	54.9	VI	53.9	VII
5	Shortage of leaf during demand for chawki	51.3	X	51.6	IX	52.9	VIII	50.6	IX	51.6	IX
	Technical constraints										
6	Lack of frequent technical guidance in pest and disease management	63.8	IV	64.3	III	57.6	IV	60.6	IV	61.6	III
7	Difficulty in harvesting leaf and shoot-let alternatively	61.4	V	61.0	IV	58.6	III	63.6	II	61.1	IV
8	Less technical support for soil health management	53.1	VIII	53.7	VIII	50.9	IX	52.8	VII	52.7	VIII
9	Lack of motivation for bio-fertilizers usage	47.2	XIII	45.0	XIII	49.1	XII	46.8	XI	47.0	XII
10	High incidence of leaf roller at times	42.0	XIV	46.4	XII	50.3	XI	48.8	X	46.9	XIII
	Economic constraints										
11	High labor wages for garden maintenance	64.8	III	55.8	V	57.5	V	54.9	VI	58.2	V
12	Add-on cost of land taken on lease	49.0	XI	55.5	VI	45.9	XIV	48.8	X	49.8	X
13	High cost of straight fertilizers	52.4	IX	50.6	X	48.2	X	46.5	XII	49.4	XI
14	Less income from bio-wastes	47.9	XII	39.2	XIV	46.9	XIII	52.3	VIII	46.6	XIV
	BC - wise overall score	58.1	-	56.2	-	55.4	-	56.6	-	56.6	-

manure application to mulberry garden, many of them expressed that sometimes FYM will not available even for purchase and they are compensating the shortage of FYM by intercropping of green manures. (Kallimani and Basavaiah, 2020). Integrated Pest Management (IPM) for major pests and Integrated Disease Management (IDM) for major diseases of mulberry are recommended. Some of the CRC entrepreneurs complained that, IPM and IDM materials are not regularly available in the market. Proper initiatives are required from the government to overcome this constraint. The last input constraint 'shortage of leaf during demand for chawki' is comparatively more severe in the CRCs of BC IV category. When the leaf yield decreased due to adverse season and also when CRCs brush the DFIs more than their capacity to exploit the situation of sudden surge in the demand for chawki, CRCs faced the problem of shortage of leaf. In such situations inevitably, they purchase the leaf from other sericulturists. Sometimes, the poor quality leaf purchased from outside affect the quality of chawki.

Technical Constraints

Among the 14 constraints and also among the five technical constrains, 'lack of frequent technical guidance in pest and disease management' was a very serious constraint with almost all the category of CRCs. The prevalence of pest and diseases are more in chawki mulberry gardens and also the CRC entrepreneurs are not well educated in understanding the management of all the pests and diseases. Hence, they felt that regular technical guidance from the department officials for the management of pest and diseases of mulberry and also to provide information on the availability of IPM and IDM materials as very much essential.

Next most important constraint with fourth rank was 'difficulty in harvesting leaf and shoot-let alternatively'. In harvesting and training schedule of chawki mulberry garden, leaf and young shoots harvesting in alternate crops is recommended. But, almost all the CRCs are harvesting only young shoots at regular intervals of 40-45 days, as they found that it saves labour and the recommended technique has not much advantages. Hence, it is suggested that scientists should demonstrate the technical advantage of their recommended practice in the field or else suitably modify their recommendation. CRCs are attending the soil testing regularly once in two years as per the recommendation. Even then, they face problems related to leaf quality maintenance which is directly related to soil health management. Hence, they felt that there should be proper technical guidance from the extension officials. Most of the CRCs are not using biofertilizers to their garden and have considered that they are not important. Many entrepreneurs also felt that there is lack of proper motivation for bio fertilizers usage. Chawki mulberry garden is maintained only for leaf of young shoots which are eaten away by leaf roller. In the study area, the problem of leaf roller was sever almost throughout the year. Hence, a large number of CRC entrepreneurs require special technical support to overcome the menace of leaf roller.

Economic Constraints

Top most important economic constraint was 'high labor wages for garden maintenance'. It also ranked fifth in overall ranking of 14 constraints and hence, a very serious constraint in chawki mulberry leaf production. CRC entrepreneurs expressed that, the labour wages are consistently increasing causing financial burden. Increasing labour wages combined with dearth of farm

Table 2.
Garrett Score (GS) and Rank (R) of Constraints faced by the CRC Entrepreneurs in the Adoption of Chawki Rearing Technologies

Sl. No.	Constraints	Brushing capacity (BC) - wise GS and R of CRCs								Average of GS & R of CRCs	
		BC I (n=44)		BC II (n=32)		BC III (n=15)		BC IV (n=9)			
		GS	R	GS	R	GS	R	GS	R	GS	R
A	**Infrastructure Constraints**										
1	Inadequate rearing space	71.4	I	68.8	I	66.1	II	75.4	I	70.4	I
2	Scarcity of skilled workers	66.8	II	64.1	IV	72.3	I	73.2	II	69.1	II
3	Lack of space for supporting activities	67.1	III	68.6	II	56.0	VI	58.9	VII	62.3	III
4	Insufficient appliances & machines	64.7	IV	53.0	XI	56.0	VI	62.7	IV	59.1	VI
5	Lack of assured quality Dfls	56.2	IX	55.4	IX	51.4	X	57.6	VII	55.2	X
B	**Extension Support Constraints**										
6	Lack of guidance to diagnose diseases	63.8	VI	64.3	IV	57.6	IV	60.6	V	61.6	IV
7	Less demand for bivoltine chawki	57.3	VI	58.7	VII	58.9	VII	53.9	VIII	57.2	VIII
8	Lack of scientific incubation facilities for bivoltine Dfls	56.8	VIII	56.1	VIII	55.9	VII	56.6	VIII	56.3	IX
9	Lack of regularity in chawki certification	54.8	XI	50.2	XIV	49.5	XI	57.6	VII	53.0	XI
C	**Socio-Economic Constraints**										
10	High wages of skilled workers	56.1	X	57.3	VI	64.9	III	67.0	III	61.4	V
11	High initial establishment cost	64.4	V	56.3	VII	56.4	V	53.1	IX	57.6	VII

Sl. No.	Constraints	Brushing capacity (BC) - wise GS and R of CRCs								Average of GS & R of CRCs	
		BC I (n=44)		BC II (n=32)		BC III (n=15)		BC IV (n=9)			
		GS	R	GS	R	GS	R	GS	R	GS	R
12	Unhealthy approach in rearing of quantity & batches per month	51.3	XV	52.8	XII	52.9	IX	50.6	XI	51.9	XIII
D	**Marketing Constraints**										
13	Chawki as perishable commodity resulting in losses	53.9	XII	53.8	X	43.6	XIV	57.6	VII	52.2	XII
14	Crop replacement in cases of failures	51.7	XIV	64.8	III	37.9	XV	52.1	X	51.6	XIV
15	Erratic demand for chawki	52.6	XIII	51.8	XIII	46.2	XIII	47.9	XII	49.6	XV
16	Demand for chawki on credit basis	36.2	XVI	42.8	XV	49.1	XII	46.8	XIII	43.7	XVI
	BC - wise overall score	57.9	-	57.3	-	54.4	-	58.5	-	57.0	-

laborers have aggravated the problems in farming sector. CRC entrepreneurs have to resolve this constraint by proper planning of activities and their management skill.

Add-on cost of land taken on lease was another important constraint felt by the CRC entrepreneurs. Many of the CRCs are not having sufficient land area on their own to raise chawki mulberry garden and have taken some land on lease basis**.** The increased lease amount will be a burden for such CRCs. 'High cost of straight fertilizers' was also a serious constraint and was uniform in all the categories of CRCs. Application of straight fertilizers is recommended but they are nearly 20 per cent costlier over the complex fertilizers. Hence, many CRC entrepreneurs who were not able to understand the efficacy of recommendation/ bear the extra cost of straight fertilizers felt that it is an additional burden. Alternatively, they are using more of complex fertilizers and thereby causing damage to soil health.

The least important constraint among the economic constraints is 'less income from bio-wastes generated'. During chawki rearing, bio-wastes like rearing bed waste, left over leaves, shoot-let bits *etc.* are generated continuously. Some of the CRCs are utilizing these wastes for composting, as feed for livestock *e*tc. But, a few CRC entrepreneurs who were not able to utilize these resources properly incurred loss and felt it as a constraint.

The constraints such as insufficient FYM at disposal, non availability of IPM/IDM

materials, high cost of straight fertilizers, less income from bio fertilizers may be solved by successful implementation of the eco-friendly cultivation practices (Murali Krishnan et al., 2015). While studying the constraints of CRCs, Vijayakumari and Rajan (2006) have remarked that that lack of knowledge about the chawki garden is one of the major constraints in CRC owners of Karnataka. Comparatively, the average Garrett score is very high in BC I which, indicated that the seriousness of the constraints was very high in BC I.

Constraints in chawki silkworm rearing

Brushing capacity-wise Garrett score and rank of various constraints faced by the CRC entrepreneurs in the adoption of recommended technologies/practices related to chawki silkworm rearing are presented in Table 2.

Infrastructure Support Constraints

As the rearing is a main activity of CRCs and it is specifically recommended to have 32' X 40' rearing hall for the rearing of 5000 Dfls/batch. A large number of CRCs were not having that much space and inevitably rear the silkworms in the limited space with crowded population of silkworms which led to poor quality of chawki. So, this was the major constraint with highest average garrett score 70.4 and first rank among the 16 constraints identified and also among the infrastructure constraints. It appeared that, these CRCs were not invested more amount on rearing house. The next major constraint among the 16 as well as five infrastructure constraints was 'scarcity of skilled workers'. Skilled workers are very essential to attend the skilled works like, brushing of hatched worms, moulting care, maintenance of micro climate *etc.* This constraint was more serious in CRCs of category BC III (IV rank) and less serious in BC II (II rank) compared to other categories. The constraint was not so serious in CRCs of BC II because of the involvement of more number of family members in the rearing activity. To overcome this constraint, it is suggested to employ the sericulture graduates for the management of rearing activities. Lack of space for supporting activities, the constraint with third rank was also more serious in CRCs with low brushing capacity (BC I and BC II) than in CRCs with high brushing capacity (BC III and BC IV). This indicated that, the CRCs with low brushing capacity are not having proper accommodation for leaf preservation, black boxing, incubation, storing of appliances, testing and certification which are very much important for smooth functioning of CRCs. The next important infrastructure constraint was 'insufficient appliances & machines'. Comparatively, it was less serious in CRCs of BC II which may be due to their medium level rearing activity. Though, there are specific recommendations for the quantity of appliances like, rearing trays, stands etc. and machines like humidifier, sprayer, heaters *etc.* required for brushing of specific quantity of Dfls. Many of the CRCs were found managing with insufficient appliances and machines compromising with the quality of chawki. To ensure quality chawki, quality of Dfls is very much essential. The studies revealed that, 80% of the Dfls are produced in the state is by private Registered Seed Producers

(Anonymous, 2018) and there are frequent complaints of poor quality of Dfls supply. Hence, many CRC entrepreneurs expressed that there were lacunae in the supply of quality Dfls.

Extension Support Constraints

Among the four extension constraints, lack of guidance to diagnose the diseases of silkworms' was found most serious with fourth rank. The young silkworms are prone to diseases which needs constant supervision by the technical persons. All the entrepreneurs are not having proper expertise and depend on skilled workers. To overcome this constraint, CRC entrepreneur should employ the technically qualified supervisors and the government should also increase the extension support to the CRCs.

The constraint 'less demand for bivoltine chawki' with eighth rank was found to be more serious. In these traditional sericultural districts, farmers are interested more in rearing of cross breed than bivoltine hybrids. Hence, CRCs were not able to promote bivoltine. Bivoltine eggs are supplied in loose eggs and need special facility for proper incubation. Majority of the CRCs lack this facility and dependent on grainages for incubation. Since, this is very crucial technology, it is suggested for establishment of mass incubation centers by government in different regions to promote bivoltine.

As per the amendment of Seed act 2006 (Angadi and Nair, 2013), CRCs need to certify the chawki for its quality, quantity as well as health status of chawki before distribution to farmers through either from CSB or DoS officials. But, this was not being regularly followed by the officials. Hence, many genuine CRC entrepreneurs who supply better quality chawki and facing unhealthy competition from CRCs who supply poor quality chawki complained that, the certification system should be strengthened. Hence, this problem needs to be addressed by the government.

Socio-economic constraints

'High wages of skilled workers' was found to be a very serious (V rank) socio-economic constraint. Comparatively, it was not so serious in CRCs of BC I (X rank) and BC II (VI rank) categories. In CRCs, heavy investment on the establishment of rearing house with appliances and machines is inevitable. So, high initial establishment cost was found as serious constraint (VII rank). In view of maintaining the quality of chawki it is recommended to rear the optimum quantity of Dfls in only three batches per month. Contrary to this, majority of CRCs rear overlapping batches with high quantity of Dflsin order to have a continuous market for chawki. It was also observed that, CRCs could lure the sericulturists by supplying 20-40 per cent of extra worms.

Marketing constraints

Chawki is a 'perishable commodity' and need to be sold to the farmers at 8th day. Many times, due to climatic variations, farmers could not procure or postpone the procurement of chawki. On such situations, CRCs discard the worms and tend to incur losses. The constraint 'crop replacement in cases of failures' was found very serious in CRCs of BC

II (III rank) unlike other category of CRCs. To compete in the market, majority of the CRC entrepreneurs replace the chawki, in case the chawki supplied earlier by them lost due to diseases. Sometimes, this practice will become a burden to the CRCs who consistently supply the quality chawki. During the period of study, demand for chawki fluctuated with seasons and price of cocoon and also became erratic occasionally. So, CRC entrepreneurs felt that such fluctuations will be problematic. As a regular practice, the sericultrists demand to privide chawki on credit basis. To survive in the business, inevitably many CRCs are extending this facility to their dependent sericulturists. Occasionally, these CRCs incurred losses due to non recovery of chawki amount. It is observed that, the marketing constraints are the result of unhealthy competition among the CRCs, which is in agreement with the observations of Shashindran Nair and Mishra (2018).

CONCLUSION

Among the various constraints faced by the CRC entrepreneurs, input constraints in the case of mulberry leaf production technologies and infrastructure constraints in the case of chawki rearing technologies are the major constraints. The input constraints may be solved by CRCs through proper planning and their management skill and also coordinating with the extension machinery. To overcome the infrastructure and economic constraints, the government should support CRCs by extending loan and subsidy facilities. The technical constraints identified are more of extension oriented problems. To overcome these constraints, extension machinery of both State department and CSB should enhance their extension support to the CRCs. The chawki marketing constraints may be resolved by framing proper guidelines and strengthening the supervision by the government. Comparatively, among the four categories of CRCs studied, the CRCs of BC III had minimum constraints indicating that they are the better models to promote the CRC concept. It is suggested to establish mass incubation centers, strictly implement the chawki certification system, restrict the activity area of each CRC/group of CRCs of a region and fix the uniform price for chawki to promote the CRC activities in the study area.

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