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**K.M. Vijaya Kumari***Silkworm Seed Technology**Laboratory, Kodathi, Bangalore,**Karnataka, India**Email: vijjikastala@yahoo.com***R.K. Rajan***Central Muga Eri Research and**Training Institute, Jorhat, Assam,**India (Retired Director of Central**Silk Board)*

## Factors discriminating high and low economic performance of commercial young silkworm rearing centres in South India

**K.M. Vijaya Kumari, R.K. Rajan**

### ABSTRACT

The objective of the study was to find out the critical pre disposing edaphic factors responsible for the viability of Commercial “Young Silkworm Rearing Centres” or ‘Chawki Rearing Centres’ (CRC), and to compare the factors responsible for low and high performance of CRCs. The linear discriminate analysis used to analyze the relative importance of discriminating variables among the high performance and low performance CRCs in southern states i.e. Karnataka, Andhra Pradesh and Tamil Nadu. The study revealed that leaf cost and experience significantly influenced the viability of Chawki Rearing Centres in Karnataka and Andhra Pradesh rearing appliances cost, leaf cost. In Tamil Nadu rearing cost, rearing appliances cost, age contributed for the viability of Chawki Rearing Centres. Youngsters should take up CRC entrepreneurship to reduce the cost of production by utilizing the available resources and by utilizing full capacity of CRCs by brushing more number of disease free layings (dfles) to get good profitable income.

**Keywords:** Commercial Chawki Rearing Centres, Linear discriminate analysis, Socio-economic factors, Rearing variables and High and low performance CRCs.

### 1. Introduction

Large scale rearing of silkworm's up to 2<sup>nd</sup> stage in required climatic conditions (28 °C & 85% R.H) and providing nutritiously rich mulberry feed raised from separate mulberry gardens as an exclusive activity by the center is known as “Commercial Young Silkworm Rearing Centre” or “Chawki Rearing Centre” (CRC). In India only 10 to 12% of farmers alone get the benefit of Chawki Rearing Centres. In China and other sericulturally advanced countries, more than 90% of farmers receive only chawki reared worms from Chawki Rearing Centres (Singh *et al.*, 2006) [1]. The advantages of commercial CRCs are raising of robust young silkworms, stabilization of crop and increase of cocoon yield, control over disease occurrence and spread, reduction in expenditure, distribution of labour for other farm works and facilitation of batch brushing and efficient crop supervision.

Chawki rearing is one of the vital activities in silkworm rearing, which enables the farmers to reap good harvest of quality cocoons. Thus, CRCs are essential for ensuring success and stability of silkworm crops besides trained / skilled manpower. Most of the sericulturists in India lack the above facilities to do chawki rearing on their own. CRCs ensure stability coupled with increase in cocoon yield and quality cocoons (Mahadevamurthy *et al.*; 2006) [4]. During 1992, under World Bank assisted project a total of 3900 CRC's were established in the country. However, most of these centres were forced to close their activities due to loss of credibility among farmers, since these centres had no support of appropriate and economically viable technology and required facilities. During late 1990's after the development of the CSR hybrids jointly under the Japan International Cooperation Agency project, once again the CRC concept came up, and well received by the farmers. The CRC model is developed by Central Sericultural Research and Training Institute, Mysore is economically viable. Many chawki rearing centres are working at private level. However, they are all for convenience sake. No CRC functioned with proper infrastructure like building and equipments, scientific way of rearing, exclusive small mulberry garden. Survey works conducted has shown that many CRCs worked as hatcheries (Geetha Devi and

### Correspondence:

**K.M. Vijaya Kumari***Silkworm Seed Technology,**Laboratory, Kodathi, Bangalore,**Karnataka, India**Email: vijjikastala@yahoo.com*

Kumeresan, 2007). After brushing chawki, worms on 1<sup>st</sup> day or 1<sup>st</sup> stage (3 days) it self distributed to the farmers without proper chawki rearing up to 2<sup>nd</sup> stage (7days). Farmers are not able to maintain the optimum temperature (27-28 °C) and humidity (85%) during 2<sup>nd</sup> stage of chawki rearing with out proper room heaters & humidifiers. Larval growth not reached up to the mark and yields are not encouraged. Hence, the productivity not improved, even though the concept was successful in other countries. In this context, a study on the commercial CRCs was taken up to find out the critical predisposing edaphic factors responsible for the viability of commercial CRC and to compare the pre disposing factors responsible for low and high performance of CRCs.

**2. Materials and Methods**

The study conducted with the Chawki Rearing Centre owners in South Indian states (Karnataka, Andhra Pradesh and Tamil Nadu), the major silk producing states in the country. The data collected through random sampling method from 50 CRCs from Karnataka, being the major silk producing state. In Andhra Pradesh and Tamil Nadu 15 CRCs each selected. The number of CRCs was only 15 in Tamil Nadu during the study period. Andhra Pradesh had less number of CRCs compared to Karnataka. Chawki Rearing Centre owners personally interviewed to collect the required information. The data collected during the year 2005-06 to compare the socio-economic characters and rearing variables in low and high performance of CRCs in South India. The linear discriminate function analysis was employed by many researchers in sericulture field viz.; Nagaraja *et al*, (1996) <sup>[5]</sup>; Shankar *et al*, (2000) <sup>[6]</sup> and Kumaresan and Geetha Devi (2009).

**2.1 Analytical framework**

The linear discriminate function used to analyze the relative importance of the differentiating variables of socio- economic characters and rearing variables between low performance and high performance of CRCs.

The linear discriminate function of the following form was employed

$$Z = \sum_{i=1}^p b_i X_i \dots\dots\dots (1)$$

Where, Z = composite discriminate score

X<sub>i</sub> = variable selected to discriminate between the groups and

b<sub>i</sub> = linear discriminant coefficients

The function constructed by choosing values of b<sub>i</sub>'s in such a way that the resulting composite score would have maximum utility in distinguishing between the two groups. The optimal values for the weighing coefficients were determined, so that the difference between the mean score for the two groups will be maximized relative to the variation with in the group. This is the ratio in between groups variance to the within groups variance.

$$f(b_1, b_2, \dots, b_p) = \frac{n_1 n_2 (b_1 d_1 + b_2 d_2 + \dots + b_p d_p)^2}{p n \sum_{i=1}^{n_1+n_2} \sum_{j=1}^p S_{ij} b_i b_j} \dots\dots\dots (2)$$

$$= (n_1 n_2 / n_1 + n_2) + (b_1 d_1 + b_2 d_2 + \dots + b_p d_p)^2 \dots\dots\dots (3)$$

Where, d<sub>i</sub> = the vector of mean difference on 'p' measures

S = within group covariance matrix

b<sub>i</sub> = unknown weighting coefficients and

n<sub>1</sub> and n<sub>2</sub> = the sample size in each group

Maximizing the above function (2) with regard to b<sub>i</sub> yields a set of P equations in P unknowns viz.

$$b_1 S_{11} + b_2 S_{12} + \dots + b_p S_{1p} = d_1$$

$$b_1 S_{12} + b_2 S_{22} + \dots + b_p S_{2p} = d_2 \quad \text{and}$$

$$b_1 S_{n1} + b_2 S_{n2} + \dots + b_p S_{np} = d_n \dots\dots\dots (4)$$

Using simultaneous equation model can solve this.

**2.2 Test of significance**

The discriminant function tested for significance to examine whether or not the variables considered together were strong enough to discriminate between two groups. This was done by using the following statistics.

$$F = \frac{n_1 n_2 (n_1 + n_2 - p - 1)}{p (n_1 + n_2) (n_1 + n_2 - 2)} \times D^2 \dots\dots\dots (5)$$

Where, D<sub>2</sub> = Mahalanobis statistic given by d<sup>1</sup>s<sup>-1</sup>d = d<sup>1</sup>b,

p = Number of variables,

n<sub>1</sub> = Number of socio -economic characters and rearing Parameters in low performance Chawki Rearing Centres and

n<sub>2</sub> = Number of socio economic characters and rearing parameters in high performance Chawki rearing centres

This follows the F distribution with (P) and (n<sub>1</sub>+n<sub>2</sub> – P–1) degrees of freedom. If the discriminate function is significant, we may conclude the discrimination between the low performance and high performance Chawki rearing centre.

**2.3 Classification of the respondents:**

The classification of the respondents in low performance and high performance was done based on Z score of each respondent.

The Z score for each group calculated as

$$Z_1 = \sum_{i=1}^p b_i X_{1i} \dots \dots \dots \text{group 1} \dots \dots \dots (6)$$

$$Z_2 = \sum_{i=1}^p b_i X_{2i} \dots \dots \dots \text{group 2} \dots \dots \dots (7)$$

Where  
 $b_i$  = the discriminant coefficients

$X_i$  = Mean value of the discriminating variables for each group.

Next, the logical point for classification of respondents into “low performing category and high performing category” would be to determine the half way between  $Z_1$  and  $Z_2$  is defined as

$$Z_c = \frac{(Z_1 + Z_2)}{2} \dots \dots \dots (8)$$

If the Z score of the respondent was less than the  $Z_c$  value, the respondent was classified as “high performing category” and if it was more the centre was classified as “low performing category”.

**2.4 Discriminating variables**

Six discriminating variables viz., age, education, experience, leaf cost, rearing appliances and rearing cost considered in the present study to be the strong discriminators for the predisposition of low income and high income CRCs. The results obtained were analyzed by using the computer software SPSS for windows version 10.0

In the present study, through the discriminate function analysis, an effort was made to identify the variables like ‘high performing category’ and ‘low performing category of Chawki Rearing Centres in South India.

**3. Results and Discussion**

It revealed that variables viz. high leaf cost, experience, age,

education and rearing appliances contributed to scientific orientation of the CRCs income discriminated these two distinct categories. The contribution of each variable considered in the model to discriminate the two groups.

**3.1. Karnataka**

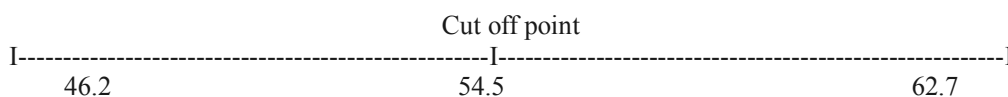
The results of discriminant function analysis for low performance and high performance CRCs revealed that leaf cost, experience, age, education and rearing appliances contributed 81.52%, 11.19%, 6.19%, 1.35% and 0.16%, respectively, for the viability of CRC. It found that there was no role of rearing cost for the viability of the CRC (Table 1). The Mahalanobis  $D^2$  for the function was found to be -16.47 and was statistically significant at 5 percent level (Table 1). Therefore, the variables considered in the function found to be useful in discriminating the respondents into “low performing category” and “high performing category”. The individual values  $Z_1$  and  $Z_2$  worked using group mean values and it was found that  $Z_1$  was 46.2 and  $Z_2$  was 62.7. The cut off point to determine the half way between  $Z_1$  and  $Z_2$  was worked out and it was found to be  $Z_c = 54.5$ . The classification of respondents based on the obtained cut off point. The ‘Z’ score of any thing less than 54.5 considered as ‘high performing category’ and similarly any thing above this value was considered as ‘low performing category’.

Karnataka CRC owners were young and highly experienced. Mulberry leaf consumption for cross breeds found to be 16 kg and for bivoltines 20 kg required up to 2<sup>nd</sup> stage per 100 dfls of chawki rearing. More number of cross breeds layings brushed and chawki rearing continued up to 1<sup>st</sup> stage (5 kg) and distributed to farmers. Hence, leaf consumption and cost less. However, the bivoltines brushed are less number but consumption is more because, bivoltines are reared up to 2<sup>nd</sup> stage. Hence, leaf cost is more. The number of trays (space) for cross breed chawki rearing up to 1<sup>st</sup> stage 24 Sq.ft (2 trays) and bivoltines needs 48 Sq.ft (8 trays). Rearing equipments cost is negligible and does not have any significance. Hence, with the perusal of the results obtained by the above analysis, it can be inferred that the socio-economic variables such as experience, age and leaf cost greatly influence the Karnataka CRCs performance in discriminating the high and low performance groups.

**Table 1:** Discriminant function for ‘High’ and ‘Low’ performing CRCs coefficients for Karnataka

Discriminating variables	Coefficient (bi s)	Group mean difference (d <sup>1</sup> -d <sup>2</sup> )	bi(d <sup>1</sup> -d <sup>2</sup> )	Percent contribution
Age	0.36	-2.81	-1.02	6.19
Education	-0.54	0.41	-0.22	1.35
Experience	0.73	-2.52	-1.84	11.19
Leaf Cost	0.69	-19.54	-13.43	81.52
Rearing Appliance	0.03	-0.90	-0.03	0.16
Rearing Cost	0.22	0.31	0.07	-0.41

F value significant at ( $P \leq 0.05$ );  $D^2 = -16.47$



### 3.2. Andhra Pradesh

The results of discriminant function analysis for low and high performance CRCs revealed that rearing appliances and leaf cost contributed to 99.98% and 0.01%, respectively for the viability of CRCs. There was no role of age, education, experience and rearing cost for the viability of the CRC (Table 2). The Mahalanobis  $D^2$  for the function was found to be -67.67 and was statistically significant at 5 per cent level (Table 2).

It was found that  $Z_1$  and  $Z_2$  were worked using group mean values and it was found that  $Z_1$  was 17.5 and  $Z_2$  was 85.2. The cut off point to determine the half way between  $Z_1$  and  $Z_2$  was worked

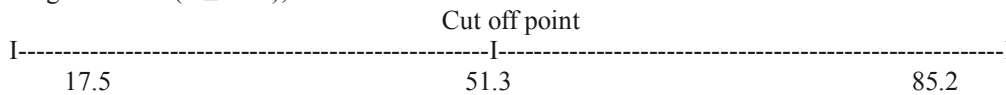
out and it was found to be  $Z_c = 51.3$ . The classification of respondents based on the obtained cut off point. The ‘Z’ score of any thing less than 51.3 considered as ‘high performance category’ and similarly any thing above this value was considered as ‘low performance category’.

Andhra Pradesh CRCs were well equipped with the required infrastructural facilities for chawki rearing and chawki rearing conducting up to 2<sup>nd</sup> stage. Due to this, in Andhra Pradesh rearing appliances contribute higher percentage on the CRC’s performance in discriminating the “high and low performance groups”.

**Table 2:** Discriminant function for ‘High’ and ‘Low’ performing CRCs coefficients for Andhra Pradesh

Discriminating variables	Coefficient (bi s)	Group mean difference ( $d^1-d^2$ )	$bi(d^1-d^2)$	Percent contribution
Age	0.001	-1.52	0.00	00.00
Education	0.001	-0.89	0.00	00.00
Experience	0.001	0.55	0.00	00.00
Leaf Cost	0.0001	-81.63	-0.01	00.01
Rearing Appliance	1	-67.66	-67.66	99.98
Rearing Cost	0.0001	-29.85	0.00	00.00

F value significant at ( $P \leq 0.05$ );  $D_2 = -67.67$



### 3.3 Tamil Nadu

The results of discriminant function analysis for low and high performance CRCs revealed that, rearing cost, rearing appliances cost, and age contributed 56.70%, 38.02% and 15%, respectively for the viability of CRC’s. It was found that there was no role of education, experience and leaf cost for the viability of the CRC (Table 3). With the Mahalanobis  $D^2$  for the fitted function to be -30.65 found to be statistically significant.

Tamil Nadu, it was found that  $Z_1$  and  $Z_2$  were worked using group mean values and it was found that  $Z_1$  was 185.0 and  $Z_2$  was 215.7. The cut off point to determine the half way between  $Z_1$  and  $Z_2$  was worked out and it was found to be  $Z_c = 200.3$ . The

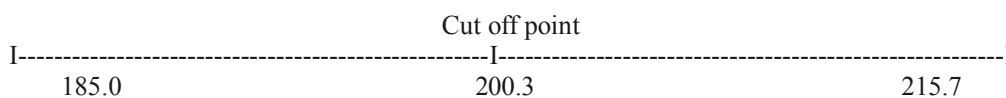
classification of respondents based on the obtained cut off point. The ‘Z’ score any thing less than 200.3 were considered as ‘high performing category’ and similarly any thing above this value was considered as ‘low performing category’.

Similarly, rearing cost, rearing appliance and age found to be significant on the CRCs performance, because of brushing more than 90% of bivoltines layings, cost of production was increased. Hence, the CRC entrepreneurs should take the measures to reduce the cost of leaf, and rearing cost contributed higher percentage on the CRCs performance in discriminating the “high and low performance groups”.

**Table 3:** Discriminant function for ‘High’ and ‘Low’ performing CRCs coefficients for Tamil Nadu

Discriminating variables	Coefficient (bi s)	Group mean difference ( $d^1-d^2$ )	$bi(d^1-d^2)$	Percent contribution
Age	0.588	-7.82	-4.60	15.00
Education	0.689	0.14	0.10	-0.32
Experience	-0.12	-3.39	0.40	-1.29
Leaf Cost	1.281	1.94	2.48	-8.11
Rearing Appliance	1.27	-9.18	-11.65	38.02
Rearing Cost	0.792	-21.95	-17.38	56.70

F value significant at ( $P \leq 0.05$ );  $D_2 = -30.65$



In the present study, “high performing” and “low performing category” of commercial CRCs in South India, the factors like leaf cost, experience, age and education are found significant in Karnataka. In case of Andhra Pradesh, rearing appliance and leaf cost found significant. In Tamil Nadu, factors responsible are rearing cost, rearing appliances and age. Hence, the youngsters should take up CRC as entrepreneurship, with full infrastructural facilities and work out to reduce the cost of production by utilizing the available resources and utilizing full capacity of CRCs by brushing more number of bivoltine disease free layings (dfls) to get good profitable income. Thus, the viability of commercial chawki rearing centres exists.

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