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Full Length Research Paper

Scope of ericulture in Assam: A micro-econometric analysis

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The paper analyses the scope of ericulture in Assam, India by theoretically and empirically examining its profitability and the excess capacity lies at the family farm level. Ericulture is a traditional agro-based sericulture activity that has been playing a significant role in generating employment and income in a slowly progressing rural economy of Assam. Among all the major silk varieties, it occupies the prime position in the sericulture sector of Assam. Though it generates substantial income and employment each year especially for the rural poor masses, its growth has not been noticeably high as the potential. The analysis proved the existence of substantial scope for enhancing the ericulture activities even at the existing level of technology and with little effort in the food leaves production and financial assistance, it may be expanded significantly that would generate further income and employment in rural Assam.

Key words: Sericulture, ericulture, informal sector, excess capacity, Assam.

INTRODUCTION

Ericulture is a traditional agro-based eco-friendly economic activity, the end product of which is "silk". In terms of contribution to employment and income by all the four major sericulture activities of Assam (viz eri, muga, mulberry and tasar), ericulture occupies the prime position among the poor rural masses (De and Das, 2009). Moreover, because of its utility (especially as winter cloth) and comparative lower price than the other silk varieties; it gained much popularity among the middle and lower middle income population across the state and other parts of India (Das, 2008). In Assam, more than 1.35 lakh families were engaged in ericulture activities during 2005 - 2006 (about 70% of the then total sericulture practising families in the state) produced about 700 MT of eri cocoon (Directorate of Sericulture, Government of Assam, 2007). Through the export of ericultural products under the initiative of Assam Apex Weavers and Artisans Co-operative Federation Limited (ARTFED), significant amount of foreign exchange have been added to government treasury every year (De and Das, 2007).

Though ericulture output has been growing significantly at 5.9% annual exponential rate (during 1980-83 to 2002-05), that has been much lower than the capacity it has for the solution of unemployment problem in rural Assam. It has been mostly practised by the poor tribal communities like Misings, Kacharis, Bodos, Mikirs, Rabhas, Karbis and Garos and in most cases their women folk practice the same to supplement their family income and also provide nutritional support through the delicious by-product, pupae. A large number of families were found to come out of poverty or acute poverty due to their engagement in eri rearing and weaving activities (De and Das, 2009). Therefore, if undertaken properly, there is ample scope for sustainable employment and income of a wider section of rural population.

Eri-fabric is called "Poor man's Silk" as it is cheaper than muga and mulberry silk (Benchamin and Jolly, 1987). Eri fabric is highly durable and has a specific thermal property, which makes it an alternate fibre to wool. Erstwhile undivided Assam is known to be the

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original home of eri and muga silk in the world and thus, they are popularly known as Assam Silk. Though ericulture is practised in almost all the districts of Assam, it is highly concentrated in the districts of Karbi Anglong, North Cachar Hills, North Lakhimpur, Dhemaji, Barpeta, Kokrajhar, Sibsagar and Darrang.

Like other sericulture activities, ericulture can be broadly divided into two parts: ericulture proper and endi-textile industry. Ericulture proper consists of sowing of seed; plantation of host plant (castor, kesseru, bar kesseru etc) on which eri worms are fed; maintenance of host plants; plucking of leaves from the planted trees or from wildly grown trees or from Eri Concentration Centres[1] (ECC); feeding and rearing of pupae up to cocoon stage; while endi textile comprises spinning of yarn and weaving of fabrics. As most of the rearers are poor, they carry out rearing activities within the premises of their dwelling houses. Here spinning and weaving are carried out by a section of eri-worm rearers, mostly at home on a very small scale with simple traditional tools (like Takli, Charkha in case of spinning and Throw-shuttle or Fly-shuttle loom in case of weaving). Of course, all the cocoon rearers are not weavers and a large section of them owing to their ignorance and poverty sell their produced cocoon to the few professional weavers working in the area or to the middlemen who collect from them on their terms and supply to the weaving mills. Therefore, the rearers receive comparatively lower price and their earning is much lower than those of eri-rearers cum endi-entrepreneurs. Besides its utility and rising popularity among the middle class population, the activities suffer from several economic and non-economic limitations that limit its growth and thus raise the questions of prospects of ericulture activities in Assam.

Although there are some studies on the scientific aspects of ericulture till now, no serious study has been made on the economic aspects of silk-culture (sericulture) especially on ericulture of Assam. An earlier survey was conducted by the Sericulture and Weaving Department of Government of Assam during 1975 - 1976 in 598 Gaon Panchayats of the plain districts of Assam to assess the position of the silk industry in terms of production and employment. It was reported that the majority of population pursuing the silk culture as leisure time occupation[2]. A few other studies in Assam and other parts of India conducted by Dutta (1983, 1988), Choudhury (1984), Ratnala et al. (1990), who tried to analyse the problems, prospects and economic conditions of sericulture sectors. However, most of them stressed on mulberry, mugaculture and related cottage industries except Dookia (1984) and Das (2007) who tried to throw some light on ericulture and eri-silk industry as a source of income and employment in India.

Dutta (1983) tried to assess the income generated by silkworm rearers using primary data despite the fact that the sample used in his study was very inadequate. He (1988) also analysed the problems and future prospects of various sericulture activities in Assam particularly in the Sibsagar district. His study however suffered from the limitation that the transport cost associated with the collection of wildly grown food leaves in case of eri and imputed labour cost was not taken into consideration for the estimation of income and profit while explaining the prospects. Dookia (1984) tried to analyse the position of eri silk industry in Indian economy as a cottage industry and discussed its role in the creation of employment and income in the rural economy. Choudhury (1984) also attempted to assess the economic importance of each variety of silk by estimating gross and net returns per hectare of land under host plant and per family of silkworm rearers. This assessment seems to be based on experiment rather than field study.

Ratnala et al. (1990) studied the employment of human labour in sericulture across different size of the farms especially of the mulberry farms in Andhra Pradesh. In their study, they found that utilisation of human labour was more in smaller farms where the attention on each activity was more than the bigger farms. They also observed a significant positive relationship between hired labour use and the size of land holding. The conclusion of the study was in favour of the utilisation of the abundant and disguisedly unemployed human resources in rural India.

Thereafter “A Study of Mugaculture with Reference to Income and Employment Generation in Kamrup District” by Paresh Chandra Das in 2002 may be mentioned. Analysing primary data collected from a sample of 736 families in Kamrup district during January 1999 to December 2002, he tried to estimate the share of mugaculture in the generation of employment. Out of 736 families, 26.87% of the respondent households were found to adopt mugaculture as a source of livelihood in his study. However, he did not estimate the scope of mugaculture to generate employment per unit of output or area under the growth of host plant.

Though there are a few studies on sericulture and particularly on ericulture in Assam and other parts of the country, none of them tried to estimate the scope and excess capacity remain in ericulture at the existing technological set up through microeconomic analysis.

With this background the present paper is an attempt to examine the prospect of ericulture in Assam. It is examined through the analysis of scope of increasing activities and thereby the revenue and profit. This paper successfully shows the existence of excess capacity of the rearers and that shows the scope for expansion of such activities in the presence of widespread unemployment, poverty and absence of smooth industrial progress in

[1]Eri Concentration Centres are set up to grow eri feed plants in order to supply leaves regularly to the rearers. At present, there are 94 ECCs in Assam covering 733.49 hectares of land (Directorate of Sericulture, Government of Assam).

[2] As there is disguised unemployment in agriculture, the rural people, especially the women folk have been engaged in such occupation. Also the male people during the lean agricultural season take part in such activities for raising a part of their family earning.

the last few decades.

MATERIALS AND METHODS

Collection of data

For the purpose of analyses, primary data are collected from 180 families chosen by multistage sampling procedure from the district of Barpeta,[3] the fourth populous district of Assam with 16.42 lakhs population staying in 1073 villages under 12 Community Development (CD) blocks. Sericulture is mostly practised in 140 villages, which are mainly concentrated in the CD blocks of Gobardhana, Jalah and Sarukhetry. At the first stage, thus those three CD blocks out of total twelve blocks are chosen purposively on the basis of the concentration of ericulture activities. Thereafter, three villages have been chosen from each of the chosen blocks (total nine villages) also purposively depending upon the concentration of such activities. Though the sample villages were chosen purposively, it represents the state of ericulture in rural Assam due to the fact that (1) it is one of the major ericulture practicing district and (2) the technology used by the farms in the chosen area are similar to those in the other districts except the concentration of activities.

From the nine selected villages, total 180 sample families are selected (23, 10 and 17 from Gahia, Agdia and Garartari villages under Sarukhetry block; 14, 21 and 35 from Salbari, Hahchara and Bhuyapara villages under Jalah block and 18, 32 and 10 from Bashbari, Nimua and Khurabari villages under Gobardhana block respectively) on the basis of the number of families engaged in such activities. From each village, the final sample families are chosen by simple random sampling without replacement from all the families practising ericulture.

From each family, information regarding the number of broods reared in the previous year, production of cocoon during the year, number of people engaged in this occupation, cost of production of cocoon, depreciation of instruments, interest paid on hired capital if any, selling price of cocoons, family income etc are collected by direct interview through a structured schedule during June 2005 to July 2006. The collected data are compiled, re-grouped and reclassified for the purpose of analysis. Moreover, cost, revenue and profit per kilogram of eri cocoon production through the plantation of host plant during 2005 - 2006 has been collected from Central Silk Board (North-Eastern Region), Guwahati. Those are considered to estimate the profitability after the revision of cost due to cultivation of castor instead of collection of food leaves from the wildly grown castor. That would provide the justification of adoption of ericulture even if there is scarcity of castor leaves in the wild.

Methods

First of all, average number of broods of cocoon harvested by an average sample family has been determined. Thereafter, correlation between the annual number of broods reared and the annual family income of the sample households has been calculated. Average revenue and cost functions are estimated and also plotted graphically for different level of broods practised by the sample rearing families. The average cost/revenue function is estimated by using the following stochastic regression equation.

After the trial of several specifications, the quadratic form of the type $Y_i = \beta_1 + \beta_2 X_i + \beta_3 X_i^2 + U_i$ is found to be the best possible fit in this case. Here, Y_i represents average cost/revenue of i^{th} farm family, X_i the level of output of the i^{th} family and U_i the random disturbance term with the classical linear regression assumptions. The intercept represents the efficiency factor as all the farms use almost identical traditional technology. Also the possibility of heteroscedastic random disturbance is checked by Goldfeld-Quandt test and it is found that the random disturbance term is homoscedastic (Ramanathan, 2002).

From those estimated average cost and revenue functions the profit function is also examined and the profit maximising level of output is estimated by simple optimisation technique. Also, the level of output corresponding to the minimum average cost is estimated by minimising the best fitted average cost curve with respect to the level of output of eri cocoon, which provides the maximum scale of an average farm at the existing level of technology. Profit maximising level of output is estimated by maximising the estimated profit function with respect to the level of output (here cocoon) while the output corresponding to minimum average cost is obtained by minimising the estimated average cost function respectively. Those are also compared with the existing level of actual output to see how much expansion of activities would be possible in order to maximise profit or minimise the average production cost. That provides a clear indication of the scope for the expansion of ericulture activity at the existing level of technology.

RESULTS AND DISCUSSION

Ericulture is multi-voltine. In a year maximum six broods of eri cocoon can be harvested consecutively if there is no constraint on the supply of food leaves. Here it is observed from the actual observation that the number of broods of the sample families practising ericulture varies from one to four in a year. A sample family on an average harvest 2.43 broods of cocoon in a year (Table 1). The short fall of broods harvested in most cases is because of shortage of castor leaves which are collected by the rearers from the surrounding wildly grown areas. The correlation between the annual number of broods reared and the annual family income of the sample households during 2005 - 2006 is observed to be –0.492, which is significant at 5% level of significance by two tailed test. It indicates that relatively poorer families are more interested in practising ericulture than the relatively well-off families in the study area. In other words, the poorer families in the area are more dependent on ericulture for their survival. Also, the correlation between the revenue generated annually from ericulture proper and the annual family income of the rearers is to be significantly negative (–0.283), which also indicates that the high income families are less dependent on ericulture for their income and vice versa. The regression of proportional contribution of ericulture to family income (Y_i) on the average family income (X_i) across the sample farms also yields

$$LnY_i = 13.154 - 1.086\ LnX_i^{*} \ldots \quad \ldots \quad R^2 = 0.946 \ldots (1)$$
$$(0.098)$$

While the regression of percentage of families adopted

[3] Though contribution to total ericulture output of the state and number of families engaged in ericulture is much larger in Karbi Anlong, North Lakhimpur, North Cachar Hills and Dhimaji district, growth rate of number of families engaged in ericulture and area under host plant is the second highest in the district of Barpeta. Moreover, growth of production per unit of land is the highest in Barpeta during the last decade (De and Das, 2007).

Table 1. Number of broods operated per family in the sample households during 2005 - 2006.

Block	Village	Household (Number)	Total number of broods	Broods per family	Total income per family (Rs)
Sarukhetri	Gohia	23	51	2.22	51869.56
	Agdia	10	32	3.20	47700.00
	Garartari	17	37	2.17	51294.11
	Sub-total	**50**	**120**	**2.40**	**50840.00**
Gobardhana	Bashbari	18	36	2.00	50555.55
	Nimua	32	86	2.68	48500.00
	Khusrabari	10	25	2.50	50800.00
	Sub-total	**60**	**147**	**2.45**	**49500.00**
Jalah	Salbari	14	34	2.43	160500.00
	Hahchara	21	53	2.53	53000.00
	Bhuyapara	35	83	2.37	56200.00
	Sub-total	**70**	**170**	**2.43**	**76100.00**
Grand Total		**180**	**437**	**2.43**	**60216.66**

Source: compiled from the field survey.

spinning and weaving (Y_i) on the average family income (X_i) across sample farms yields

$$Y_i = 31.13 + 0.0002\,X_i^{*} \ldots \quad \ldots R^2 = 0.512 \quad \ldots (2)$$
$$(7.58E^{-05})$$

Here figures in the parentheses represent standard error of the coefficients and slope coefficients are significant at 1% level of significance by two tailed test. The first equation showed that the poorer across all categories are more dependent on ericulture while the second one reveals that relatively richer village adopted more spinning and weaving activities along with rearing. In other words, due to lack of capital the poorer section have little chance of adopting weaving activities simultaneously along with rearing (Das, 2008).

Though rearing of cocoon alone does not contribute much to the family income (Appendix 1), the spinning and weaving activities along with the rearing contribute significantly to the employment and income of those families (De and Das, 2007). Not only that, it also helps a significant portion of those extremely poor families to come out of poverty (Appendix 2).

Total revenue generated and cost incurred in the production of eri cocoon by the sample families has been illustrated in Table 2. The table showed that 180 sample families together generated a sum of Rs 368064.5 total revenue from the production of 1267.63 kilogram of eri cocoon (revenue from cocoon and pupae) during 2005 - 2006. A sum of Rs 19947.00 was spent by the rearing families to make up the annual depreciation of rearing appliances, cost of seed, and cost of transportation for the collection of leaves etc. Thus, the rearers together earned a gross profit of Rs 348117.50 over the explicit cost of production. Gross profit from a kilogram of cocoon production was thus Rs 274.62. Of course, this gross profit included the imputed cost of self-employed labour. Imputed labour cost is much higher than the explicit cost of production of cocoon. Taking into account the wage of similar other activities (existing agricultural wage), a sum of Rs 185592.50 would be the approximate opportunity cost of family labour used for the purpose. Therefore, total net profit earned by the rearers would be only Rs 162525. Net profit per kilogram of cocoon production was calculated at Rs 128.21 while estimated gross profit per kilogram was Rs 274.62, and that was associated with significant inter-village variation.

Gross profit as well as net profit per kilogram of cocoon production was the highest in Gahia village in Sarukhetry block with Rs 313.88 and 160.48, respectively, while it was the lowest in Agdia village with Rs. 228.61 and Rs. 41.77 within the same block. In the village Agdia, gap between gross and net profit per kilogram of eri cocoon was much higher due to relatively higher wage rate that these villagers could earn as agricultural labourer as compared to their counterpart in other villages.

From Figures 1 to 4, It is observed that the average revenue curves are almost horizontal but the average cost curves corresponding to different (one, two, three and four) broods harvested by different sample families have different shapes. The average revenue curve always lies above the average cost curve across all levels of activities and hence there is substantial positive profit generated over the cost per unit of output by various farms. From the pictures it appears that the rate of profit margin is more in case of smaller farm, rearing one or two broods in that year. However, the scope of profitability rises with the level of output of eri cocoon, as the average revenue curve is almost horizontal (as most

Table 2. Cost, revenue and profit in the production of eri-cocoon by the sample households during 2005 - 2006.

Block	Village	Production of cocoon (Kg)	Total revenue (Rs)	Average revenue (Rs)	Total explicit cost (Rs)	Gross profit over total explicit cost (Rs)	Implicit labour cost (Rs)	Net profit over total cost (Rs)	Gross profit per Kg (Rs)	Net profit per Kg (Rs)
Sarukhetri	Gohia	148.00	49090.00	331.68	2637	46453.00	22702.50	23750.50	313.88	160.48
	Agdia	79.00	19690.00	249.24	1630	18060.00	14760.00	3300.00	228.61	41.77
	Garartari	120.60	36446.75	302.22	1985	34461.75	16965.00	17496.75	285.76	145.08
	Sub-Total	347.60	105226.80	302.73	6252	98974.75	54427.50	44547.205	284.74	128.16
Gobardhana	Bashbari	106.73	29812.45	279.33	1495	28317.45	14480.00	13837.405	265.32	129.65
	Nimua	249.55	77245.50	309.54	4220	73025.50	34680.00	38345.50	292.63	153.66
	Khusrabari	76.45	20537.50	268.64	1010	19527.50	10479.00	9048.50	255.43	118.36
	Sub-Total	432.73	127595.00	294.86	6725	120870.00	59639.00	61230.905	279.32	141.50
Jalah	Salbari	93.50	25695.00	274.82	1365	24330.00	14238.00	10092.00	260.22	107.94
	Hahchara	150.50	41282.50	274.31	2100	39182.50	22407.00	16775.50	260.35	111.47
	Bhuyapara	243.30	68266.00	280.59	3505	64761.00	34881.00	29880.00	266.18	122.81
	Sub-Total	487.30	135243.50	277.54	6970	128273.50	71526.00	56747.5	263.24	116.45
Grand Total		1267.63	368064.50	290.36	19947	348117.50	185592.50	162525	274.62	128.21

Source: Compiled from the field survey.
Notes: (1) Total revenue includes the revenue from cocoons as well as pupae. (2) Total cost includes expenditure incurred on seeds, rearing house, annual appliances, cost and transport, cost of collection of leaves of feed plant.

of the rearers sell their cocoon at the same price) and average cost curve is downward slopping and convex to the origin and becomes asymptotic after certain level of output and that varies for different size of farms in terms of broods harvested.

The level of performance and the scope of enhancing production and earning by the different level of rearers at the existence level of technology are explained with the help of the estimated average cost and revenue functions. Figures 1 to 4 present the average revenue and average cost functions for different groups of rearers harvesting one to four broods of eri cocoon throughout the year. The average revenue and cost functions for different sample brood farms are estimated by regression method. Here the quadratic forms are found to be the best estimates. The estimated average revenue (AR) and average cost (AC) functions for different brood levels are presented in equations 3 to 10.

For the farms practicing one brood in a year

$$AR = 294.46 + 61.89X - 9.137X^2 \ldots R^2 = .253, \bar{R}^2 = .202, F = 4.93^*, N = 32$$
(9.42)* (2.96)* (-2.77)* … … … (3)

$$AC = 453.378 - 136.45X + 12.732X^2 \ldots R^2 = .786, \bar{R}^2 = .771, F = 53.12^*, N = 32$$
(8.28)* (-3.73)* (2.202)** … … … (4)

For the farms practicing two broods in a year

$$AR = 476.11 - 26.366X + 2.0075X^2 \ldots R^2 = .108, \bar{R}^2 = .16, F = 3.18^{**}, N = 69$$
(12.54)* (-2.03)** (1.85)** … … … (5)

$$AC = 466.67 - 80.576X + 4.532X^2 \ldots R^2 = .934, \bar{R}^2 = .932, F = 463.97^*, N = 69$$
(20.413)* (-10.30)* (6.908)* … … … (6)

For the farms practicing three broods in a year

$$AR = 101.317 + 54.172X - 3.49X^2 \ldots R^2 = .252, \bar{R}^2 = .202, F = 3.04^{**}, N = 37$$
(2.005)** (2.344)**(-2.40)** … … … (7)

$$AC = 709.97 - 108.66X + 5.258X^2 \ldots R^2 = .929, \bar{R}^2 = .925, F = 223.95^*, N =$$
(11.76)* (-7.044)* (5.411)* … … … (8)

For the farms practicing four broods in a year

$$AR = 416.72 - 3.025X + 0.008X^2 \ldots R^2 = .31, \bar{R}^2 = .26, F = 9.6^*, N = 39$$
(2.98)* (-2.28)* (.008) … … … (9)

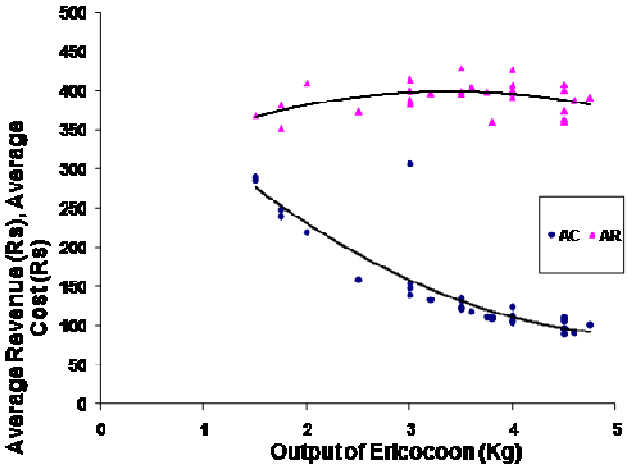

Figure 1. Average revenue and average cost curves of the rearers practicing one brood in a year.

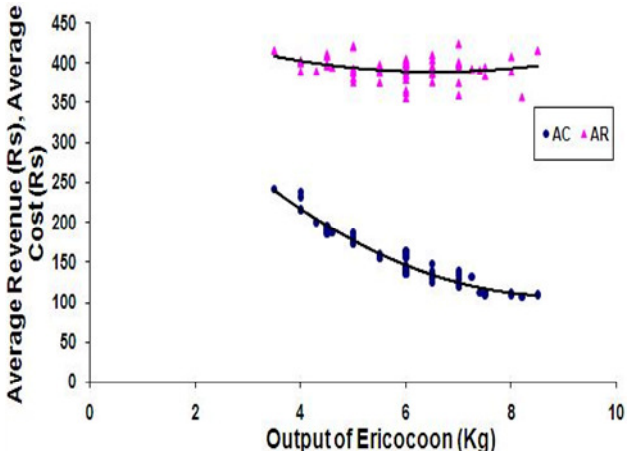

Figure 2. Average revenue and average cost curves of the rearers practicing two broods in a year.

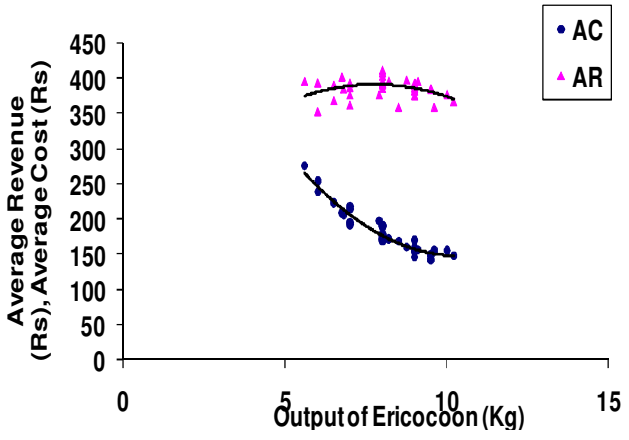

Figure 3. Average revenue and average cost curves of the rearers practicing three broods in a year.

$$AC = 463.13 - 35.001X + 0.85X^2 \ldots R^2 = .919, \bar{R}^2 = .915, F = 204.64^*, N = 39$$
(9.302)* (-4.14)* (2.422)** … … … (10)

The figures in the parentheses represent t value. Here * and ** indicate that the test statistic is significant at 1 and 5% level of significance by two tailed test.

Table 3 shows that for various levels of broods actual eri-cocoon outputs are well below their efficient level of productions. In order to maximise profit, each producer with different brood level can increase production on an average from 30% to about 143% in a year at their existing technology and even without increasing the number of broods harvested by each of them. Thereby, the level of profit can be increased from about 32 to 168% approximately. Among all the sample farms, those who rear brood twice a year; are found to seriously under-utilise their capacity. The under-utilisation in some cases has been due to the shortage of caster leaves that may be grown under the initiative of the rearers or may be supplied by others. If the food leaves are cultivated then there is a chance of rise in cost of production (as shown in Table 4) of the extra unit of output and thus the average cost curve would shift upward. Yet there would be some profit as shown in Table 4 and hence total profit will certainly increase if not exactly to the extent as estimated here. The rate of profit may even be increased if modern equipments are used to reduce unit cost of production and the activity is undertaken on a larger scale that would generate economies of scale (as seen here an average rearer at each level is producing at the point on the downward falling portion of the average cost curve).

It is thus observed that instead of perusing ericulture as a part time occupation, there is enough scope of expansion of this culture. If ericulture is practised in a scientific and professional way and managed through the production of castor (food) leaves, cost of production undoubtedly increases as mentioned earlier. For example, if plantation of host plant is done by the rearers and they use separate rearing house instead of their residential compound, cost of production increases by several times. However, with regular supply of food leaves, production of cocoon as well as pupae also increases. Increase in production helps them to be organised and attract better price for cocoon and its by-product pupae. It is because of the fact that the traders will visit them regularly as they can get cocoon in bulks and quality of output will be better. Hence revenue earned is also found to be much higher if all the pupae are sold at the reasonable price, which may be even higher than the revenue from cocoon (as observed from the data obtained from Central Silk Board).

Table 4 reveals that profit per kg of cocoon in case of those in other areas who cultivate food leaves and maintain separate house for culturing ericocoon is slightly lower than that of rearers in Barpeta who collect leaves from nature. Although average profit per kg of cocoon is higher in case of naturally collected leaves, there is a

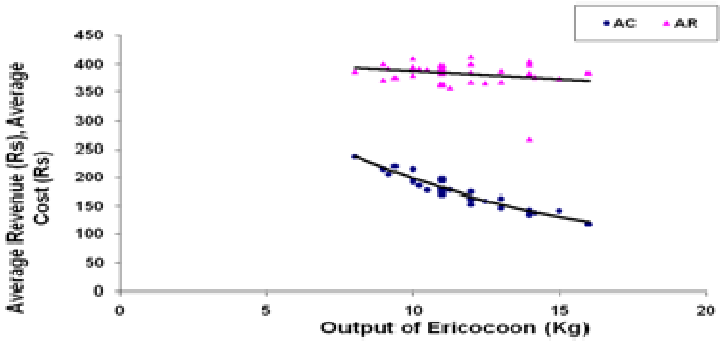

Figure 4. Average revenue and average cost curves of the rearers practicing four broods in a year.

Table 3. Brood-wise actual, profit maximising and lowest possible average cost output of eri-cocoon and scope of increasing output and profit as obtained from the estimated result by using sample data.

Number of broods	Average yearly output of cocoon per family (Kg)	Average yearly profit maximising output of cocoon per family (Kg)	Average yearly output of cocoon per family corresponding to lowest average cost (Kg)	Scope of percentage increase in	
				Output to maximise profit	Yearly total profit
1	3.428	5.615	5.359	63.80	64.56
2	5.920	14.400	8.890	143.24	168.06
3	8.038	10.488	10.330	30.48	31.60
4	11.597	24.460	20.500	110.92	130.01

Note: Output corresponding to lowest average cost and maximum profit is estimated by minimising best-fitted average cost function and maximising the best-fitted profit function respectively as obtained from the sample data.

Table 4. Cost, revenue and profit per Kg of Eri-cocoon production with and without plantation of host plant during 2005 - 2006.

	Cost, revenue and profit per kg of cocoon production	*With plantation (Rs)	Without plantation (Rs)
Items of cost	1. Plantation	172.76	00
	2. Fixed Cost	126.60	2.73
	(a) Rearing house	100.00	00
	(b) Appliances cost	26.60	2.73
	3. Wages	175.00	146.41
	4. Others	32.50	12.85 (Transport cost)
	Total cost	506.87	161.99
Revenue	Revenue from cocoon	280.00	209.26
	Revenue from Pupae	350.00	81.10
	Total revenue	630.00	290.36
	Net profit	123.13	128.37

Sources: (1) Compiled from Field Survey. (2) *Office of the Directorate, Central Silk Board (North-Eastern Region), Guwahati, India.

constraint in the expansion of their activity (average 2.43 broods only). If host plants are cultivated, more broods (maximum six in a year) can be harvested and thus more profit can be generated by the rearers. Hence cultivation of food leaves is not uneconomic if it is done scientifically as well as commercially.

It is also observed from Table 4 that even if castor is cultivated scientifically and marketing of main and

by-products is done properly, profit rate would not reduce much, rather it enhances the scope for increasing overall profit through the rise in gross production. Therefore, to meet the shortages of food leaves, systematic plantation of host plant may be advocated. If plantation of host plant (castor) is done scientifically, the rearers can have regular and adequate supply of leaves and thus can practice and harvest maximum possible broods, successively every year as full time occupation and earn reasonable income.

If more people are engaged in such activities or the existing rearers expand their activities, then their marketing potential would certainly improve. However, most of the sample rearers are found not to avail institutional credit (Das, 2008). This bottleneck can be removed through the formation of self-help group or expansion of banking activities in the area.

Conclusions and policy implications

The present study reveals that there is substantial scope for the expansion of ericulture in Assam and particularly in Barpeta district. There is a scope to further increase earning through increasing activities due to the existence of both external and internal economies of scale. This would help increase in employment and income of those poor households who have been suffering from chronic unemployment and sustenance. Deficiency of eri food plants is one of the important limitations for the growth of ericulture in Assam. The rearers can be encouraged to cultivate feed plants as it is observed that even if castor is cultivated scientifically, there is still sufficient profit in this culture. Moreover, the Government may establish more ECCs and expand the existing ECCs in collaboration with the department of social forestry and encourage private entrepreneurs to establish ericulture farm. At the same time, indiscriminate cutting down of naturally grown silkworms' feed plants should be prevented by strictly enforcing the existing law. Moreover, to meet the shortage of silkworms' feed plants and to increase production of cocoons, the state government may acquire wasteland and allot the same to the local silk rearing co-operatives, self-help groups (if any) or diligent rearers for the growth of silk production. Extensive plantation of secondary feed plant like *Borkesseru*, Tapioca etc can also be encouraged to meet the deficiency of feed leaves for eri silkworms during the crisis of castor.

Apart from that, produced seeds of castor can be used for the production of highly expensive castor oil, which will definitely raise the income of the rearers. Though marketing of cocoon is found to be an important problem to the rearers, if the proposed spun mill in Assam is materialised (there is a proposal of large spun mill, which is yet to come) it will surely raise the demand for eri cocoon and help them to have remunerative price for their product in near future. Moreover, to eliminate the role of middleman traders who exploit the rearers by offering a low price for cocoon, co-operatives, self-help groups may be formed. This process will raise the bargaining strength of the rearers cum weavers and help them to have respectable price. It is observed that the rearers of Hahchara village within Jalah CD block who have formed self-help group have been able to get higher price. Similarly, Roje Eshanshali Co-operative Society Ltd of Kokrajhar has been successful in removing the plight of the rearers of the area to a certain extent (Das, 2008). Government marketing personnel (Cocoon Marketing Inspectors for cocoon) and agencies like ARTFED; Assam Government Marketing Corporation limited (AGMC), North-Eastern Handicrafts and Handloom Development Corporation Limited (NEHHDC), Assam Khadi and Village Industries Board (AKVIB) etc (for eri fabric marketing) can be re-activated. Finally co-operation of various sections like government officers, artisans, traders, rearers, weavers etc engaged in activities related to ericulture is necessary for the successful growth of the sector.

Limitations of the present analysis

Majority of rearers have provided some quantitative information such as figures of annual eri cocoon production, annual sales proceeds from ericulture, amount of investment in plantation and collection of leaves etc, from their memory other than from books of accounts. Some of them even were not aware of the modern weight and measures system. Most of the rearers have not maintained proper books of accounts. Appropriate care was however taken in filling up the schedules during the survey.

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Appendix 1. Contribution of Ericulture to the Income of Sample Households during 2005 - 2006.

Block	Village	House-hold (Number)	Total income of the sample families (Rs)	Income from ericulture proper (Rs)	Contribution of ericulture proper to total family income (%)	Total income per family (Rs)
Sarukhetri	Gohia	23	1193000	49090	4.11	51869.56
	Agdia	10	477000	19690	4.12	47700.00
	Garartari	17	872000	36446.75	4.17	51294.11
	Sub-total	50	2542000	105226.75	4.13	50840.00
Gobardhana	Bashbari	18	910000	29812.45	3.27	50555.55
	Nimua	32	1552000	77245.5	4.97	48500.00
	Khusrabari	10	508000	20537.5	4.04	50800.00
	Sub-total	60	2970000	127594.95	4.29	49500.00
Jalah	Salbari	14	2247000	25695	1.15	160500.00
	Hahchara	21	1113000	41282.5	3.70	53000.00
	Bhuyapara	35	1967000	68266	3.47	56200.00
	Sub-total	70	5327000	135243.5	2.53	76100.00
Grand Total		180	10839000	368064.45	3.39	60216.66

Source: Compiled from field survey.

Appendix-2. Percentage change in poverty due to ericulture.

Block	Village	House-hold (Number)	Number and percentage of households below poverty		Percentage decline in poverty due to ericulture activity	Percentage of families practicing spinning and weaving
			Without income from ericulture	With income from ericulture		
Sarukhetri	Gohia	23	7 (30.43)	6 (26.08)	14.29	26.09
	Agdia	10	6 (60.00)	6 (60.00)	0.00	50.00
	Garartari	17	6 (35.29)	6 (35.29)	0.00	35.29
	Sub-total	50	19 (38.00)	18 (36.00)	5.26	34.00
Gobardhana	Bashbari	18	6 (33.33)	5 (27.77)	16.68	44.44
	Nimua	32	15 (46.87)	12 (37.5)	19.99	43.75
	Khusrabari	10	7 (70.00)	6 (60.00)	14.28	40.00
	Sub-total	60	28 (46.66)	23 (38.33)	17.85	43.33
Jalah	Salbari	14	5 (35.71)	5 (35.71)	00	64.29
	Hahchara	21	12 (57.14)	12 (57.14)	00	47.62
	Bhuyapara	35	14 (40.00)	11 (31.42)	21.45	45.71
	Sub-total	70	31 (44.28)	28 (40.00)	9.66	50.00
Grand Total		180	69 (38.33)	78 (43.33)	11.54	43.33

Source: Compiled from field survey.
Note: Figures in the parentheses represent percentage of families below poverty line.