



Bivoltine Sericulture Development in Penukonda, Ananthapur District of Andhra Pradesh through Cluster Promotion Programme (CPP)

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ABSTRACT

To register an impressive growth on the sericulture front in India in terms of quality and productivity but failing to give significant impact in the international market as because still it is trailing in the shadow of cross breed (CB) cocoon production which has no international value. Therefore, to elevate India in to International market the Cluster Promotion Programme (CPP) was implemented under XII five year plan during 2013-2019 in India for boosting the bivoltine sericulture development, the Central Silk Board (CSB) and state sericulture department, have jointly organised 174 clusters all over India i.e. 102 clusters in 5 states of Southern zone, 45 in 5 states of North-western zone, 11 in 3 states of Central Western Zone, 7 in 3 states of Eastern zone and 9 in 8 states of North Eastern zone, respectively. Out of 102 clusters in Southern India 46 clusters were implemented in Karnataka, 28 clusters in Tamil Nadu, 17 clusters in Andhra Pradesh, 4 in Maharashtra whereas 2 in Kerala with an anticipated 167.06 lakh disease free layings (DFLs) brushing and generate 1920MT of bivoltine raw silk.

Out of the 17 clusters of Andhra Pradesh, Penukonda has been recognised as one of the potential clusters under Ananthapur district. Due to CPP implementation during 2013-2019, Bivoltine DFLs brushing under the cluster was raised from the bench mark level (0.45 lakh) to progressive level of 1.17 lakh (2013-14), 1.12 lakh (2014-15), 2.81 lakh (2015-16), 3.62 lakh (2016-17), 5.96 lakh (2017-18) and 7.68 lakh (2018-19) with a progressive increase of 18.5 to 40% DFLs brushing target and 103.6 to 300.0% increase over benchmark brushing during the XII plan contributing 219MT of bivoltine raw silk under Penukonda cluster during 5 years period. Similarly, cocoon yield per 100 DFLs also recorded significant level of increase ranging from 63.40kg to 79.64kg per 100 DFLs compared to the bench mark yield of 42.5kg/100DFLs. Moreover, the bivoltine sericultural development during XII five year plan (2013-19) has fetched the progressive average market rate from Rs. 286.0 to 452.0 per Kg compared to the benchmark rate of Rs. 225.5 during 2011-12 by the adopted silkworm rearers under the cluster thereby improving the socio economic conditions of the sericultural fraternity.

Key words: Bivoltine cocoon, CPP, DFLs, Sericulture, Silkworm rearing.

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INTRODUCTION

Production of gradable quality bivoltine silk has become the prime agenda of Indian sericulture industry. In recent years though India has registered an impressive growth on the sericulture front, in terms of quality and productivity, yet it is often felt that there exists a gap in the yields between what the technologies could fetch the farmer and what he is actually getting. India being the largest consumer of natural silk in the world and demand for quality raw silk has been increasing in the country gradually over the years. The annual raw silk production was 20,410 MT in 2010-11 and did not suffice the actual requirements of the country. As a result, India had to import 5,870 MT of raw silk and 3780 MT silk fabrics^{2,9}. As the demand-supply gap is widening in mulberry silk, there is urgent need to improve the production, productivity and quality of Indian raw silk for meeting the requirement for domestic market to become self-reliant by phasing out import of raw silk and compete in the international market especially in the changing scenario of the global trade. However, there is a major challenge to enact in this direction, that being over 90% of our production has upgradable quality. Ultimately to overcome with the present situation judicious efforts for increasing the bivoltine silk production in the country is the solution.

To pursue the goal of bivoltine sericulture development, a well organised and planned strategic extension system is very much essential for transfer of new bivoltine sericulture technologies so as to achieve the targeted production. Jaishankar and Dandin³ emphasised on the effective extension communication mechanisms, percolation of cost-effective technologies that fit well into the region and followed by the better interaction and involvement of Scientists, extension and field functionaries towards the end users to identify, assess and find a solution to a problem. These kind of participatory approaches will definitely results in achieving the anticipated targets. In this direction many extension approaches such as Catalytic

Development Programmes (CDP), Institute Village Linkage Programmes (IVLP) and Technology Validation and Development Programmes (TVDP) have adopted by the Central Sericultural Research and Training Institute (CSR&TI), Mysore was adopted this ideal concepts in sericulture for the transfer of technologies to the farmers from time to time with the support of State Sericulture Department and the results were encouraging⁸. Among them cluster development approach is one such approach, which is holistic, information based and participatory extension mode with Research-Extension-Farmer (R-E-F) linkage. This approach was effectively implemented in the form of five year plans during 2009-12 for large scale promotion of bivoltine sericulture in India particularly in Southern major silk producing regions and the results was encouraging^{2,4,9}.

The Cluster Promotion Programme (CPP) was implemented under XII five year plan during 2013-2019 in India for boosting the bivoltine sericulture development, the Central Silk Board (CSB) and state sericulture department, have jointly organised 174 clusters all over India *i.e.*, 102 clusters in 5 states of Southern zone, 45 in 5 states of North-western zone, 11 in 3 states of Central Western Zone, 7 in 3 states of Eastern zone and 9 in 8 states of North Eastern zone, respectively. Out of 102 clusters in Southern India 46 clusters were implemented in Karnataka, 28 clusters in Tamil Nadu, 17 clusters in Andhra Pradesh, 4 in Maharashtra whereas 2 in Kerala with an anticipated 167.06 lakh DFLs brushing and generate 1920MT of bivoltine raw silk.

Among 17 clusters of Andhra Pradesh, historically important Penukonda about 70 km away from Ananthapur district was considered to implement Cluster Promotion Programme (CPP) from April, 2013 to March, 2019 with the objectives to increase production and productivity of bivoltine sericulture effectively in India. Penukonda has its own identity for choosing as one of the biggest cluster among the others. Further Penukonda has become best choice of cluster

for bivoltine sericulture development as because, it has got 27,382 population spread among 96 villages having 67.2% literacy with 38.1% working population. The unique feature of Penukonda is it consists with 49.4% female population with 29.7% literacy, 48.1% of girl child population. The Taluk also full pledged with 11.4% Scheduled caste and 4.3% Scheduled tribe population projecting itself as much integrated population. Therefore, sericulture being a cottage industry is highly dependent on family labour and encourages women empowerment. With all the above added advantages the CPP was initiated in the area.

MATERIAL AND METHODS

The cluster promotion programme (CPP) was implemented in Penukonda, Ananthapuram District for 5 years i.e. from April, 2013 to March, 2019. The Penukonda area experiences temperatures ranging from 18°C in winter and a maximum of 43°C during summer with a normal rain fall of 553 mm where as low rain fall of 341- 400 mm. The area also witnesses moderate to high density of pump sets, low level irrigation with low cropping intensity. Mulberry cultivation exists with the competitive crops like dominated with food grain crops along with vegetable and horticultural crops in and around the area. The area consists with predominantly 78% of red alfisol soils followed by 20% of black soils dominating with sandy loamy in nature texture⁵. However, before the initiation of XII five year plan in Ananthapur District, it consists with 3,897 acres of mulberry spread over 326 villages among 2,226 farmers. During the period 2010-11, Penukonda cluster area farmers brushed 36,750 DFLs of Bivoltine with 53.0 kg/100 DFLs yield and 1, 66, 200 cross breed (CB) DFLs with 62.25 kg/100DFLs yield contributing 25,134 kg raw silk production of CB and bivoltine. Similarly during 2011-12 a total of 30,700 bivoltine DFLs were brushed with 60.88kg/100 DFLs and 1,09,100 DFLs of cross breed were brushed and attained 58.31 kg/100DFLs yielding 11,758 kgs of CB and bivoltine raw

silk production. The above information indicates that CPP, Penukonda is not new for bivoltine sericulture but traditional for bivoltine as well as cross breed. CPP was implemented in order to increase bivoltine silk production exclusively for 5 years i.e. from 2013-2019 under XII five year plan under Penukonda cluster. In the CPP approach a cluster of villages and sericultural families located nearby were selected and adopted to have areas/mass effect of the improved technologies incorporated under the programme so that the activities are manageable easily with the limited technical (Scientist & Technical staff) and extension field functionaries jointly by the active involvement of local stake holders. Under this programme, contiguous villages within the radius of around 20-30km are selected to save time and money on transport and to facilitate closer monitoring and interactions of scientist as well as field functionaries with cluster farmers and to ensure good and anticipated results. One village or a cluster of villages located nearby is selected such way that as far as possible eligible farmers of villages/cluster of villages are covered under the CPP^{6,9}.

Initially, a preliminary bench mark survey was conducted jointly by the Scientist and Dept. of Sericulture (DOS), Penukonda to understand the status of mulberry area, variety, spacing, rearing house and rearing facilities to quantify the requirement of farmers and also funds to meet the farmers requirements. Basing on the survey the assistance is provided to the farmers through Catalytic Development Programme (CDP) to strengthen the facilities, encourage and motivate the bivoltine sericulture farming under the cluster. For effective implementation of the cluster activities the following steps were imparted:

- CPP, Penukonda was operated under the control of South nodal center Regional Sericultural Research Station (RSRS), Ananthapur, Andhra Pradesh and the Scientist as Cluster Development Facilitator (CDF) and Technical Staff of REC, Penukonda were implemented the CPP activities of Penukonda with closed

- co-ordination of extension officer as another CDF and field functionaries of DOS, Penukonda.
- For technology intervention, a localized Chawki Rearing Centre (CRC) was recognized followed by the proper training to the entrepreneur at CSRTI, Mysore and required financial assistance was extended under CDP to provide inputs support and service to the cluster farmers.
 - For each crop, the chawki worms were reared at CRC and healthy and robust chawki worms were supplied after joint quality Chawki certification by the co-ordinating Cluster Development Facilitators (CDFs) - Scientist and DOS official.
 - Both the CDFs, subject specialists as well as other Technical and field functionaries regularly visited the farmers mulberry gardens and silkworm rearing crops and extended technical guidelines for quality mulberry leaf production and successful rearing crops.
 - Time to time non-performing farmer garden soils were analyzed for their soil reaction (pH & EC) and nutrient (OC%, available. P & K) parameters, basing on the soil analysis amelioration recommendations were served so as to improve their garden soils for enhanced quality leaf production.
 - Also supplied sunhemp (*Crotalaria Juncea*) green manure seeds (@ 8kg/ac to sow during monsoon) under INM to enrich the soil nutrient status and biological control agents to control Tukra (with *Cryptolaemus montrouzieri*) and Leaf roller (with *Tricogramma chilonis*) as IPM components to minimize the leaf loss due to the above pests.
 - Biocontrol agents of *Nesolynx thymus* to control Uzi menace for silkworm crops.
 - The farmers were motivated for indenting and rearing bivoltine as well as improved double hybrid races in all the seasons in a year and rearing performance data were collected after each rearing crop.
 - The farmers were encouraged to undergo various kinds of trainings as imparted at the main institute as well as other training centers of state and central Govt.
 - Besides, various kinds of ECPs as enlisted in the Table 1 were conducted under cluster villages to educate the farmers on various improved technologies for encouragement and boosting the confidence levels in rearing bivoltine silkworm crops.
 - The crop performance was monitored constantly and periodically at higher level meetings in regard to the achievements against the targets.
 - During the CPP progress review meetings the performance of the respective clusters as against the targets were assessed, depending on their performance necessary target alterations will be made.
 - Study tours organized to understand the adoption levels of sericulture technologies and interaction with progressive formers at field level.
 - The CPP implementation for 5 years under Penukonda cluster impact study was conducted to analyze the impact of CPP on cocoon production quality, cocoon quality and economic benefit of the sericulturists were assessed and the results are presented in **Table 1 and Fig. 1.**

RESULTS AND DISCUSSIONS

Before initiation of the Cluster Promotion Programme (CPP) a bench mark survey was conducted very meticulously during 2011-12 to assess the initial status of existence of bivoltine sericulture and the technical knowhow of the mulberry and sericulture farming in and around the Penukonda cluster. Survey revealed that both bivoltine and cross breed (CB) silkworm rearing was existing in the cluster to a limited level. The bench mark survey revealed that the average disease free laying (DFLs) brushing was ranging at 0.45 lakh with a insignificant level of cocoon yield of 42.5kg/ 100dfls with a market value of Rs. 226/- per kg indicating the uneconomic and

not a viable venture of adopting sericulture by the farming community. After imparting the CPP by involving all the modalities during 2013 to 2019 for 5 years during the XII five year plan the sericulture has shoot up to the expected levels and proved to be a workable and economically viable venture for the socio economic upliftment of the sericultural farming community raising the hopes of their safety and security. Five years efforts in implementing the bivoltine sericulture in Penukonda cluster were presented in the **Table 1& 2** and **Figure 1 (1a to 1d)**.

It was observed that the Bivoltine DFLs brushing under the cluster was raised from the bench mark level (0.45 lakh) progressively from 1.17 lakh (2013-14), 1.12 lakh (2014-15), 2.81 lakh (2015-16), 3.62 lakh (2016-17), 5.96 lakh (2017-18) and 7.68 lakh (2018-19) with a progressive increase of 18.5 to 40%. However, in the beginning year's viz. 2013-14 and 2014-15 the distribution of DFLs was not appreciable due to many reasons. However, when compared with the bench mark level of brushing during 2011-12 after

the implementation of CPP the brushing of DFLs under the cluster has shown marked increase ranging from 103.6 to 300.0% during the 5 years plan contributing 219MT of bivoltine raw silk under the Penukonda cluster during 5 years period (**Fig.1a**). Yield of cocoon per 100 DFLs also recorded significant level of increase ranging from 63.40kg to 79.64 kg per 100 DFLs compared to the bench mark yield of 42.5 kg/100 DFLs (**Fig. 1b**). The increase DFLs brushing and cocoon yield/100DFLs may be due to the better adoption of critical technologies in imparting recommended manure and fertilizer applications and adopting soil analysis based amelioration of their mulberry gardens and effective disinfection of silkworm rearing houses by the use of improved disinfectants such as Asthra & Serifit followed by the personal hygiene and better rearing management and the results are in agreement with the earlier studies conducted^{3,1,7}. This study is also corroborated with the similar study conducted by other Scientists in various clusters^{8,2,9}.

Table 1: Improvement of bivoltine sericulture among farmers on various aspects under CPP programme at Penukonda

CPP Activities	Bench mark	During the CPP implementation period					
		2013-2014	2014-2015	2015-2016	2016-2017	2017-2018	2018-2019
Target of DFLs brushing (lakh)	0.45	1.40	1.60	2.00	3.00	4.30	6.50
DFLs distribution (Lakh)	0.55	1.17	1.12	2.81	3.62	5.95	7.68
DFLs harvested (Lakh)	0.42	1.16	0.70	2.81	3.62	5.95	6.98
Actual Yield (MT)	0.23	74.59	44.64	201.72	255.51	433.60	523.22
Cocoon yield (kg)/100 DFLs	42.5	64.60	63.40	71.73	79.64	72.85	74.99
No of adopted farmers	165	471	254	1186	1496	2522	3544
Average Market rate (Rs/kg)	225.5	409.0	383.0	286.0	405.0	452.0	375.0
Adopting of new plantation (no)	--	60	45	50	344	538	375
New Mulberry plantation (acre)	--	60	40	50	344	540	332
*ECPs organized (No)	--	13	17	9	13	15	11
No of farmers sensitized	--	693	435	430	644	990	651

*ECPs= Extension and Communication Programmes

Moreover, bivoltine cocoons generated by the CPP adopted farmers fetched higher market price in the cocoon market ranging from Rs. 286.0 to Rs. 452.0/kg during the CPP period 2013-2019 compared to the benchmark rate of Rs. 225.5/kg during 2011-12 due to

improvement in cocoon quality (Table 1 & Fig. 1b). The results of the study are in conformation with the study conducted by Singh *et al.* and Himantharaj *et al.*². Due to intensive efforts such as imparting integrated nutrient management (INM) to improve

farmers garden soils through green manuring by sowing sunhemp (*Crotolaria juncea*), dhaincha (*Sesbania bispinosa*), cowpea (*Vigna unguiculata*) and horse gram (*Macrotyloma uniflorus*) etc. in monsoon crops, use of integrated pest management (IPM) through the supply of biological control agents such as lady bird beetles (*Scymnus coccivora* and *Cryptolaemus montrouzieri*) for tukra and *Trichogramma chiloins* for leaf roller to enhance quality mulberry leaf production. Whereas, biocontrol agents of *Nesolynx thymus* to control Uzi menace during silkworm rearing and Asthra and Serifit as effective rearing bed disinfectants for newly evolved silkworm rearing crops were played a major role in preventing the silkworm rearing crops

failures and contributing in producing enhanced quality cocoon (Table 1 & Fig. 1). The improved rearing technologies popularized among the farming group also resulted in minimizing the cocoon melting percentage. Again it is proved that the prevention of silkworm rearing crops and reduction of defective cocoon percentage is also due to the result of the intensive efforts made by way of organizing several kinds of extension and communication programmes (ECPs) as detailed Table 2 and training programmes in sensitizing and generating awareness among the sericultural farming community on sorting of infectious and ill healthy bivoltine silkworms as stated by Himantharai et al.² and Sudhakar et al.⁹.



Fig. 1a: Achievement of bivoltine DFLs brushing against the target

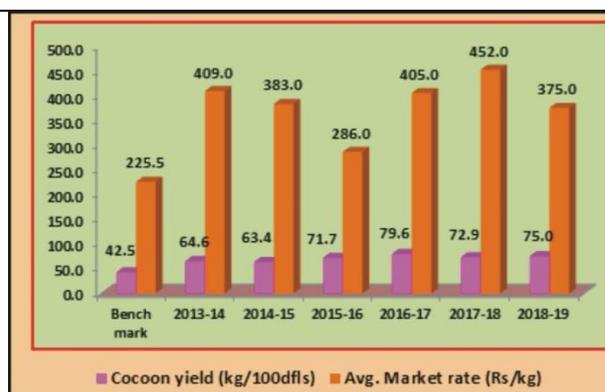


Fig. 1b: Cocoon yield per 100 DFLs & average market rate

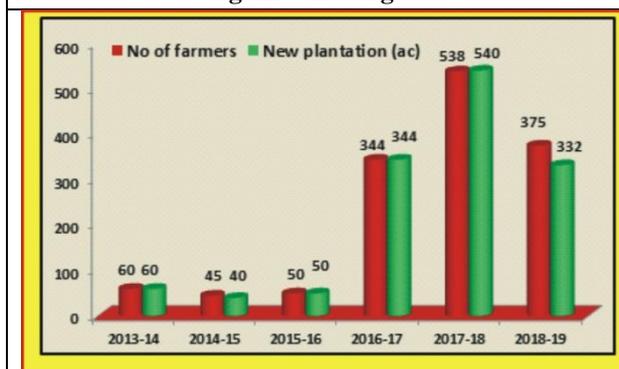


Fig. 1c: New mulberry plantation undertaken among the farmers

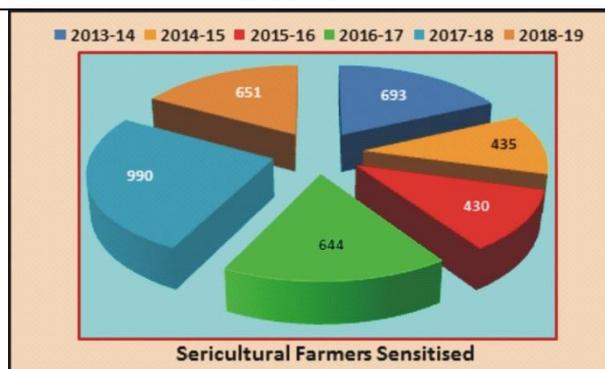


Fig. 1d: Sensitisation of sericulturists through the imparting of ECPs

Fig. 1: The figure showing the enhancement and improvement of bivoltine sericulture under CPP, Penukonda

During the cluster promotion programme period under Penukonda cluster the farmers were motivated in under taking new mulberry plantation, rearing house construction, infrastructural facilities of rearing and

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mulberry garden establishment by supporting under various Govt. subsidized programmes such as Catalytic Development Programme (CDP), State Sericulture Development Programme (SSDP), Mahathma Gandhi

National Rural Employment Generation Programme (MGNREGA), Rashtriya Krishi Vicas Yojana (RKVY) and Prime Minister Krishi Sichayee Yojana (PMKSY) and several central Sector Schemes (CSS) etc. During the programme period 2013-2019 a total of 1,412 farmers have undertaken 1366 acres of new mulberry plantation with high yielding mulberry varieties like V1 and G4 in varied geometries such as paired row [(3'x2')⁵], 3'x3' and 4'x4' in lowbush form and wider spacings like 6'x3', 8'x4' and as 10'x10' spacing in tree form with partial irrigation or micro irrigation (drip irrigation) conditions to combat with the prevailing drought stricken conditions in Penukonda area under Ananthapur District, Andhra Pradesh.

From the initiation of CPP new plantation of 60 acres among 60 farmers (2013-14), 45 acres among 40 (2014-15), 50 acres among 50 (2015-16), 344 acres among 344 (2016-17), 538 acres among 540 (2017-18) and 375 acres among 332 farmers, respectively was undertaken (**Table 1 & Fig. 1c**). During CPP implementation under Penukonda clusters 80 Extension and Communication Programmes (ECPs) of various kinds as detailed in **Table 2 & Fig. 2** was organized and sensitized 3,843 serifarming communities. Enthusiastic participation of sericulturists' during ECPs under CPP, Penukonda cluster during 2013-2019 is also one of the main reasons for the successful implementation of CPP and achieving anticipated results in bivoltine

sericultural developmental programme. During the CPP programme significant improvement in socio-economic conditions of the serifarming community was noticed. The programme supported the farmers in adoption of bivoltine sericulture, earning encouraging money, investing the same for sericulture upliftment, purchasing land, vehicles, jewels, house hold articles, improved children education, conducting respectable rituals and becoming self sufficient in repayment of long pending borrowed loans.

Thus, the success of the programme can be attributed to co-ordinated and close working of different organizations involved in sericulture development such as REC, CSRTI, Mysore, National Silkworm Seed Organization (NSSO), Central Silk Technological Research Institute (CSTRI), Bangalore and State Sericulture Department at gross root level as well as higher level for common cause. Further, the cluster approach helped in succeeding in pooling the resources such as man power, money, and infrastructural facilities *etc.*, for conducting extension programmes effectively. The CPP offered how best the limited resources could be effectively utilized for promotion of bivoltine sericulture. Intensive ECPs undertaken under CPP, Penukonda and active participation of the sericultural fraternity (**Fig. 2**) are helped the farmers to accept and adopt the improved technologies and achieve the anticipated and encouraging results in improving bivoltine cocoon yield levels significantly^{2,10,6,9}.





Fig. 2: Sensitization of sericultural farmers on various improved technologies during ECPs organized under Penukonda cluster

Table 2: ECPs under taken to sensitize the sericulturists on improved technologies for the development of bivoltine sericulture under CPP, Penukonda

ECPs Particulars	No of ECPs & farmers sensitized during the period											
	2013-14		2014-15		2015-16		2016-17		2017-18		2018-19	
	No of ECPs	No of Farmers	No of ECPs	No of Farmers	No of ECPs	No of Farmers	No of ECPs	No of Farmers	No of ECPs	No of Farmers	No of ECPs	No of Farmers
Awareness Programme	3	145	2	55	1	88	2	247	3	417	1	139
Farmers Day (FDs)	--	--	--	--	--	--	2	118	4	337	4	236
Field Day (FDs)	2	76	2	50	--	--	1	102	--	--		
Farmers Skill Training (TUPs)	3	45	7	105	1	10	2	20	2	30	1	15
Farmers Study Tour	1	25	--	--	--	--	1	13	--	--	--	--
Group Discussions	2	55	2	45	7	332	5	144	6	206	5	261
Film shows	2	77	2	40	--	--	--	--	--	--	--	--
Exhibitions	1	135	1	90	--	--	--	--	--	--	--	--
Enlightenment programme	1	135	1	90	--	--	--	--	--	--	--	--
TOTAL	15	693	17	435	9	430	13	644	15	990	11	651
GRAND TOTAL	During XII plan programme a total of 80 ECPs were organized sensitizing 3,843 farmers on improved technologies.											

CONCLUSION

Therefore, with the above depicted results the study can be concluded that the improvement

indicates the success of CPP programme during XII- five year plan at Penukonda during 2013-19 is nothing but intensive adoption of

integrated technology in cluster approach is one of the remedy for attaining sustainability of sericulture. This approach is with suitable refinement can be adopted elsewhere in the sericulture areas of the country to ensure higher rate of adoption of technologies, higher returns from sericulture and promotion of bivoltine sericulture during future course of five year plans. Further, it is essential to continue the intensive bivoltine promotion programmes of this kind in future in the new clusters established under CPP so as to make our country self sufficient and self reliable in quality bivoltine silk production thereby projecting India as one of the potential bivoltine silk producers at international market.

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