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Impact of cluster promotion programme on silk industry in Uttarakhand

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Abstract
Sericulture is well established agro based cottage industry in many parts of the country including Uttarakhand. The farmers of northern region of the country hesitate to grow mulberry on their prime land due to stiff competition with existing agricultural crops *viz*., wheat, paddy and sugarcane. However they have shown keen interest in sericulture as an additional alternative to improve upon their income. Sericulture may provide livelihood of low income rural folk at their door step. Sericulture, as a farm based enterprise, is quite suitable to small and marginal farmers' with less capital investment. The diversified activities in avocation of sericulture provide opportunities to all the age group of the family to get themselves involved to earn their livelihood. Further, the integrated approach for the development of sericulture has been adopted. This paper discusses the progress made in cluster approach and future prospect of sericulture in Uttarakhand.

Keywords: Cluster, sericulture, bivoltine, Uttarakhand

Introduction
Sericulture is practiced in about 761 villages of Uttarakhand out of about 16,000 villages. About 10,500 families are engaged in different facets of the silk industry [1]. This state is generally referred as "Bowl of Bivoltine silk of India". Earlier, sericulture activity was mainly taken on mulberry bush plantation throughout the country including Uttarakhand. In the recent years, mulberry sericulture has been transformed from a subsistence type to a modern scientific enterprise in most of the traditional as well non-traditional states. Considering its transformation to a modern scientific enterprise, Central Silk Board in association with respective Directorate of Sericulture (DoS) has launched various programmes for development and improvement of socio-economic conditions of poor sericulturists but these schemes/programmes did not give the desired impact on developmental activities leading to insufficient livelihood generation. Further, the silkworm rear of Uttarakhand are small or marginal farmers and not ready to raise mulberry plantation on their prime land due to stiff competition with other cash crops. Though, it was reported that mulberry cultivation is more economical as bush over trees plantation, under sub-tropical conditions of North India, recording more than double leaf production per unit area [2]. In the present scenario, sericulture industry in Northern states of the country sustains mostly on mulberry trees existing road side, ward side, river banks and boundary plantation thereby forming a major source of foliage [3]. Many of the high yielding varieties are already in the field and technologies are also developed, accordingly, for the maximum exploitation of the evolved breeds / races [4, 5]. The demand-supply gap of silk in India is widening and need to improve the production and quality of silk to meet the requirement for domestic market, become self-reliant by phasing out imports of raw silk and compete in the international market. In the changing scenario, planned extension system is very much essential for transfer of new sericulture technologies, so as to achieve the targeted production.

Cluster development programme is basically oriented towards horizontal expansion through increased area under mulberry cultivation and vertical growth by increasing production and productivity of cocoons both quantitatively and qualitatively. Under mulberry, special emphasis has been made for bivoltine silk which would have an edge or is competitively at par with the imported silk in respect of quality and cast. This will not only check the import of raw silk but also safeguard the interest of the primary producers of the country. Keeping in view the importance of production of higher-grade raw silk especially bivoltine in bulk quantity to reduce the imports and creating more employment in rural/ semi urban areas through

sericulture practices, cluster development approach, which is holistic, information based and participatory extension mode with Research-Extension-Farmer (R-E-F) linkage was adopted.

During XI plan, Cluster Promotion Programmer was initiated in Kalsi area of Dehradun on pilot basis and 300 mulberry saplings per unit was considered for plantation. In view of the less land holding by the farmers and earlier study [6] it had been decided to raise the mulberry plantation on bunds of the agricultural fields etc. so that the mulberry wealth could be increased and maintained on minimum expenditure and sericulture activity may sustain for long. On the performance of cluster promotion programme implemented during XI five-year plan, this approach was applied for large-scale promotion of bivoltine sericulture in India during XII plan in 2013 by Central Silk Board in association with Directorate of Sericulture, Uttarakhand. Seven clusters *viz*, Kalsi (Dehradun), Tiparpur (Dehradun), Maldevta (Dehradun), Lalwala (Haridwar), Pauri (Pauri Gharhwal), Thari-giantigaon (Nainital) and Kopa-chankpur (U.S.Nagar) were started. In the present paper, progress made under said clusters are discussed.

Materials and Methods

Silkworm rearing is conducted twice in a year i.e., spring and autumn seasons in Uttarakhand. Quality region and season specific bivoltine silkworm seed (disease free layings - DFLs) were obtained from NSSO, Bangalore through DOS, U.K., Dehra Dun. Since, chawki rearing is very delicate and sensitive hence chawki rearing centres (CRCs) are established by the department to conduct young age (Chawki) silkworm rearing. Chawki rearing was conducted at respective CRCs established in the area on prescribed temperature (26-28 ^{O}C) and humidity (80-85%) by the department [7, 8] so as to improve the cocoon productivity. Chawki reared silkworms were distributed to the selected beneficiaries. Late silkworm rearing was conducted at farmer's places as per the recommended package of practices [7, 8] under the close supervision of technical staffs and officers. After completion of the feeding period i.e., 22-24 days, ripped worms were mounted for cocooning and were harvested on 6th & 7th day of mounting during spring and autumn respectively. Data on rearing performance/parameters were collected and analyzed.

Results and Discussion

The Cluster Promotion Programme by CSB in coordination with the States for supporting bivoltine sericulture was continued during XII plan on the performance of the clusters initiated during XI plan in Kalsi (Uttarakhand) and others North – West states of the country. Seven clusters are being implemented in Uttarakhand out of seven clusters, three in Dehradun and one each in Haridwar, Pauri Gharwal, Udhamsingh Nagar and Nainital districts. Further, CSB has decided to carry forward and extend the Cluster Promotion Programme up to March'2020. The details of the farmers covered under said clusters are given in the table – 01.

Table 1: Category wise and sex wise distribution of cluster farmers

#	Name of the cluster	Nos. of farmers						Total
		Category wise				Sex wise		
		SC	ST	OBC	General	Male	Female	
1	Maldevata	85	4	-	235	202	122	324
2	Tiparpur	1	239	5	5	205	45	250
3	Kalsi	61	164	21	4	157	93	250
4	Lalwala	393	-	15	2	273	137	410
5	Pauri	239	-	-	334	345	228	571
6	Kopa chankpur	98	257	157	198	637	92	729
7	Thari-gintigaon	66	30	5	394	449	46	495
TOTAL		943	694	203	1172	2268	763	3029

It is apparent from the table-01 that Maldevta, Pauri and Thari-gintigaon have maximum general category beneficiaries whereas Tiparpur, Kalsi and Kopa chanakpur have ST farmers. Lalwala cluster (Haridwar) has maximum SC farmers. Maximum beneficiaries belong to general category (38.69%) followed by SC (31.13%), ST (22.91%) and only 7.29% were from OBC category in over-all cluster farmers (Fig-01). Further, 74.88% beneficiaries are males and only 25.12% are females (Fig-02).

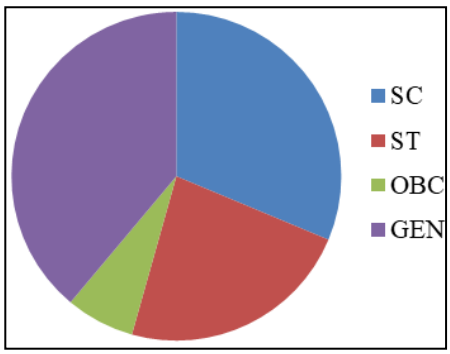

Fig 1: Category Wise Distribution of Total Cluster Farmers

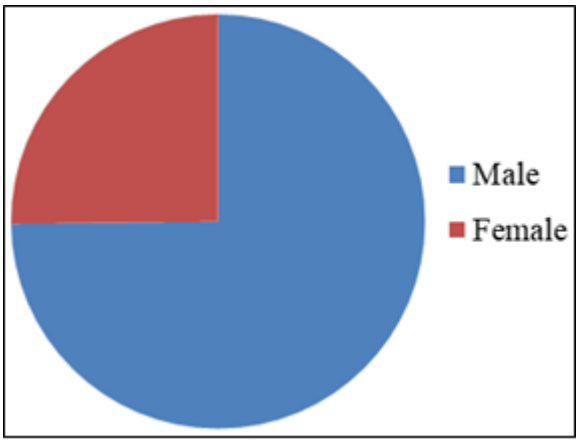

Fig 2: Sex Ratio of Total Cluster Farmers

Fig-03 shows that seed intake increased over the years in both the seasons this indicates interest of the local people in sericulture activity. Further, the seed intake during autumn season was more than the spring season in 2014, 2015 and 2016. This is due to the availability of more foliage with newly raised mulberry plantation in autumn season.

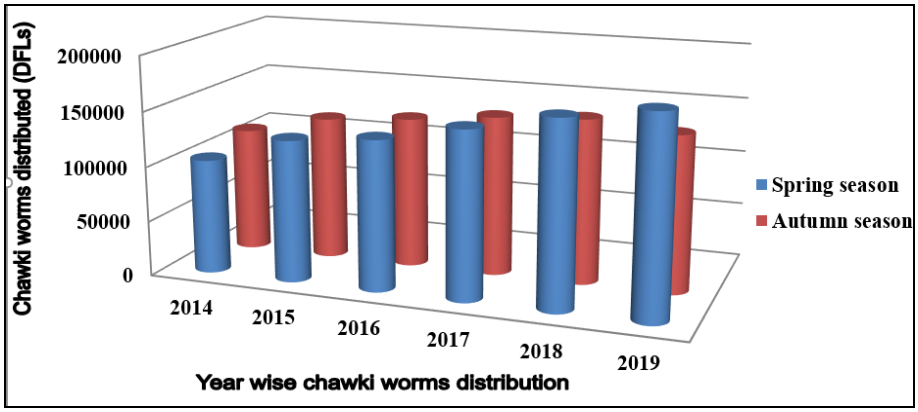

Fig 3: Chawkie Silkworms Distributed During Different Seasons & Years

Table 2: Crop wise achievements of different clusters of Uttarakhand

Sl. No.	Name of Cluster	Season	Bivoltine silkworm seed distributed (dfls)	No. of rearers	No of villages covered	Total cocoons harvested (kg) (green)	Yield / 100 dfls (kg)
1	Maldevta	Spring,14	13000	320	46	6582.70	50.64
		Autumn,14	12600	314	40	4566.30	36.24
		Spring,15	15000	382	47	7550.82	50.34
		Autumn,15	a15000	350	54	5475.00	36.50
		Spring'16	15000	335	39	7452.40	49.60
		Autumn'16	15000	330	39	5460.00	36.40
		Spring,17	15000	335	39	7522.50	50.15
		Autumn,17	15000	335	39	5355.00	35.70
		Spring,18	18700	324	39	9371.00	50.11
		Autumn,18	14700	295	39	5115.20	34.80
		Spring,19	16000	226	37	7752.30	48.45
		Autumn,19	12225	226	52	4090.50	33.46
2	Lalwala	Spring,14	5500	185	17	2006.95	36.49
		Autumn,14	4750	141	6	1314.60	27.68
		Spring,15	15000	476	45	7425.00	49.50
		Autumn,15	15000	481	51	4200.00	28.00
		Spring'16	14500	510	45	7003.50	48.30
		Autumn'16	15000	510	45	4996.50	33.31
		Spring'17	20000	510	45	9820.00	49.10
		Autumn'17	15000	510	45	5115.00	33.00
		Spring'18	20000	410	31	9180.00	45.00
		Autumn'18	15000	444	31	4950.00	33.00
		Spring,19	21000	570	43	9450.00	45.00
		Autumn,19	16000	570	46	4920.00	31.00
3	Kopa Chanakpur	Spring,14	21050	646	120	10208.62	48.50
		Autumn,14	28600	646	40	8773.45	30.68
		Spring,15	25000	646	82	11201.00	44.80
		Autumn,15	29000	729	43	10179.60	35.10
		Spring'16	26000	729	43	11466.00	44.10
		Autumn'16	30000	729	43	10500.00	35.00
		Spring,17	30,000	729	22	13485.00	46.50
		Autumn,17	30000	729	22	10020.00	35.40
		Spring,18	33000	729	43	15443.00	46.79
		Autumn,18	33400	740	47	12569.00	37.63
		Spring,19	39200	740	44	16147.60	41.19
		Autumn,19	33500	740	43	11390.00	34.00
4	Thariginti Gaon	Spring,14	20800	475	95	10087.00	48.50
		Autumn,14	25000	475	40	8486.30	33.95
		Spring,15	22000	475	73	10055.00	45.70
		Autumn,15	25000	495	40	8944.60	35.77
		Spring'16	26000	495	40	12064.00	46.40
		Autumn'16	26000	495	40	9386.00	36.10
		Spring,17	28500	495	14	13423.50	47.10
		Autumn,17	30000	495	14	10830.00	36.10
		Spring,18	33000	495	43	15443.00	46.79
		Autumn,18	31400	510	53	12189.00	38.82
		Spring,19	33700	510	42	14221.40	42.20
		Autumn,19	32000	510	42	12096.40	37.80

5	Pauri	Spring,14	9000	351	60	4185.00	46.50
		Autumn,14	9300	370	65	3180.70	34.20
		Spring,15	12400	416	65	5828.00	47.00
		Autumn,15	9000	398	65	3213.00	35.70
		Spring'16	13100	419	65	6091.50	46.50
		Autumn'16	10500	413	65	3423.00	32.60
		Spring,17	18100	540	112	8145.00	45.00
		Autumn,17	15000	557	112	9322.10	30.17
		Spring,18	23100	573	117	8778.00	38.00
		Autumn,18	15200	524	117	5320.00	35.00
		Spring,19	25100	573	117	10793.00	43.00
		Autumn,19	8200	379	76	2905.30	35.43
6	Tiparpur	Spring,14	19135	247	8	8536.25	44.61
		Autumn,14	18000	250	8	6420.00	35.67
		Spring,15	20265	242	8	10124.10	49.96
		Autumn,15	17800	232	8	6443.60	36.20
		Spring'16	21425	234	08	10822.50	50.51
		Autumn'16	20000	234	08	7510.00	37.55
		Spring,17	20000	240	08	10100.00	50.50
		Autumn,17	21000	240	08	7380.00	36.90
		Spring,18	21000	237	08	11241.60	49.24
		Autumn,18	19875	230	08	6996.40	35.20
		Spring,19	22000	240	08	10890.00	49.50
		Autumn,19	20000	240	08	7420.00	37.10
7	Kalsi	Spring,14	15550	250	17	7939.00	51.05
		Autumn,14	15430	250	17	5812.90	37.67
		Spring,15	19000	250	17	10488.39	55.20
		Autumn,15	20000	250	17	8064.90	40.32
		Spring'16	20000	250	17	10950.80	54.75
		Autumn'16	20000	250	17	7470.90	37.35
		Spring'17	20000	250	17	10150.00	50.75
		Autumn'17	20250	250	17	7360.00	36.80
		Spring'18	20000	250	17	9998.00	49.99
		Autumn'18	20000	250	17	7200.00	36.00
		Spring,19	22000	250	17	10846.00	49.30
		Autumn,19	20000	250	17	7226.00	36.13

Raw silk production is directly proportional to cocoon production. Cocoon quantity and quality depends on climatic conditions (Temperature & Humidity) prevails during silkworm rearing. Fig.-04 shows that raw silk (MT) production was better during spring season that autumn season and total raw silk production has increased over the year. Further, the spring season is congenial for silkworm rearing throughout the Northwest India as the optimum temperature and humidity prevails in the environment during rearing period whereas autumn season is unfavourable due to high temperature and high humidity prevailing in the environment. Hence, average cocoon production (kg/100 DFLs) in spring season is more than autumn season resulting in more raw silk production in particular season and year.

The success of the sericulture industry depends upon several variables, but environmental conditions such as biotic and abiotic factors are of particular importance. Among the abiotic factors, temperature plays a major role on growth and productivity of silkworms [9, 10]. Temperature plays a vital role on the growth of the silkworms. As silkworms are cold-blooded animals, temperature will have a direct effect on various physiological activities. In general, the early instar larvae are resistant to high temperature which also helps in improving survival rate and cocoon characters. The temperature has a direct correlation with the growth of silkworms; wide fluctuation of temperature is harmful to the development of silkworm. Rise in temperature increases various physiological functions and with a fall in temperature, the physiological activities are decreases. Increased temperature during silkworm rearing particularly in late instars accelerates larval growth and shortens the larval period. On the other hand, at low temperature, the growth is slow and larval period is prolonged. The optimum temperature for normal growth of silkworms is between 20 °C and 28 °C and the desirable temperature for maximum productivity ranges from 23 °C to 28 °C [11, 12]. It is reported that the optimum temperature for the production of quality cocoons ranges from 22-28 ^{O}C [12, 13]. Similarly, the optimum humidity ranges from 70-85% for successful silkworm rearing resulting in quality cocoons production. The day to day, season to season and year to year variations in the environmental conditions within the same season also affects on the productivity. It emphasizes the need of temperature and relative humidity for sustainable cocoon production as observed in the present study and in accordance with the earlier findings [13]. In general, the early instar larvae are resistant to high temperature which also help in improving survival rate and cocoon characters [14]. The seasonal differences in the environmental components such as temperature, relative humidity, light and nutrition considerably affect the genotypic expression in the form of phenotypic output of the silkworm crop such as cocoon weight, shell weight and ultimately cocoon shell ratio [13].

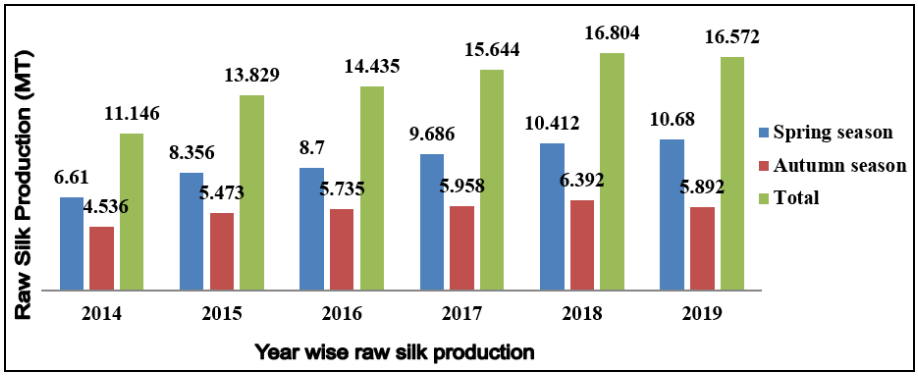

Fig 4: Raw Silk Production During Spring & Autumn Seasons in Different Years

Owing to the crunch in shortage of manpower at state and Central Silk Board (CSB) level, the cluster approach helps in effective technical guidance to farmers with the limited number of scientists and extension workers. The cluster approach ensures an integrated response, drawing upon the comparative advantages of all the agencies working for sericulture development. Further, it ensures coordination among different agencies, joint programming, information and knowledge sharing by combining support and common services. Thus, the cluster approach had proved to be an emerging tool which helped to bring out high impact on the overall crop improvement among the farmers adopting the latest technologies developed by CSB Research Institutes.

Conclusion

In cluster approach, effective R-E-F linkage is maintained and technology spread is affected from rearers to rearers. This will minimise the widening ratio between farmers and extension worker by sharing the experiences of lead farmers and their interaction with other rearers. This indicates that sericulture activity provides employment to the rural people and migration of rural people to the urban area may be checked to some extent. It can be concluded that farmer's participatory extension communication programmes, its effective diffusion and adoption of improved sericultural technologies at field level has improved cocoon productivity resulting in improving socio-economic status of sericulture farmers. Cluster approach also helps in developing mulberry wealth and rearing facilities to the rearers for continuing sericulture in coming years.

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