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Evaluation of Trend Analysis of Sericulture Resource Development in North Western Himalayan Region of Kashmir Valley, Jammu and Kashmir, India

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ABSTRACT

Sericulture is an agro cottage industry that plays a significant role for sustainable livelihood in rural and urban economy of Kashmir. It includes backward and forward linkage processes from mulberry plantation, silkworm rearing, reeling, silk textile weaving. The present study was conducted to examine growth in mulberry area, production and productivity of silk cocoons which was collected over the period of 30 years from 1990-2020 in Kashmir valley. To carry out the analysis, secondary data sources have been used by taking into consideration the compound annual growth rate, regression analysis and decomposition model to achieve objectives of the study. The perusal of results indicate that the trend of production and yield of silk cocoons witnessed an increase atthe rate of 1.59 and 2.79 from 1990-91 to 2019-20 and mulberry area shows signs of decreasing trend at the rate of -1.14 during the last three decades (1990-2020). The decomposition model analysis predicted that silk cocoon production is mainly contributed by yield effect (59.27 %) followed by interaction effect (46.10 %) and area effect (-5.37 %). Therefore, the need of sericulture policy interventions and supply chain collaborations by the Government and comprehensive strategic approach is required which is not only important from viewpoint of potential income generating activities but also as the key contribution to the GDP of the Jammu and Kashmir economy.

Keywords : Silk farming, Kashmir valley, CAGR, Regression analysis, Decomposition model, Sustainability

Silk farming comprises rearing of silk producing organisms and the word sericulture is derived from Greek word sericos meaning silk and English word culture means rearing. It broadly includes interrelation of activities such as cultivation of mulberry plant, silkworm rearing to produce the silk cocoons, cocoon reeling for untwisting silk filament, yarn making, weaving and silk fabric processing (Kumaresan *et al*., 2008). Sericulture involves raw silk production by raising silkworms which provides income generation round the year to farm families (Kamili *et al.,* 2000; Lakshmannan *et al.*, 2011). Mulberry silk is commonly known in the textile industry (Wang, 2010 and Babu, 2015). It is an important economic subsidiary income generating activity for rural people of mountainous regions and provides livelihood in industries being an important activity in urban economy and contributes sustainable development of region (Meneguim *et al.,* 2007).

Mulberry silk is obtained from silkworm (*Bombyx mori* L). Silkworm feeds on mulberry leaves and spins silk cocoon in about 28-30 days. Finally silk cocoons are sold to the reelers and convert them into silk yarn. Bivoltine silk of Jammu & Kashmir is of high quality which adds to the improvement of economic condition of the sericulture farmer and provides employment opportunities in pre-cocoon and post cocoon sector. Jammu & Kashmir could be converted into silkworm gene bank for sustaining sericulture of the whole world (Tazima, 1978).

In Kashmir valley silk is produced from almost all areas which includes Kupwara, Baramulla, Anantnag, Bandipora, Kulgam, Budgam, Ganderbal, Shopian and Srinagar shown in Fig 1. Introduced by Emperor Zain-ul-Abidin, silk industry plays an important role as a small and medium scale industry for sustainable livelihood of small and marginal families. Mulberry silk

cocoon in the study area yields a very fine fiber that can be compared with the best in the world. This region currently produces 805 metric tons of silk cocoon and generates five lakh man-days of employment annually. It engages around 22,000 farmers directly or indirectly with the industry (Anonymous, 2020). The present objective of the study was to find out sericulture scenario in Kashmir valley by exploring the data on trend of mulberry area, production and productivity of silk cocoons for time period from 1990 to 2020.

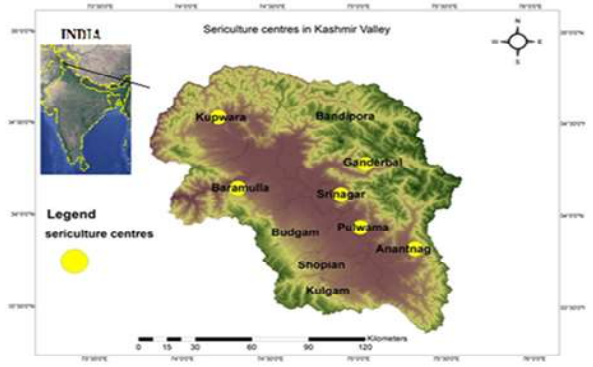

Fig. 1 : Sericulture pockets in Kashmir valley
(Source: Directorate of sericulture, Jammu &Kashmir, Srinagar)

Geographically, large chunk of silk in the world comes from Asia which contributes over 95 per cent of the total world output. China ranks firsts in term of silk production with an annual production of 142,005 metric tonnes in 2017 (Anonymous, 2017). Sericulture acts as an effective tool for poverty alleviation that contributes to sustainable development goals in many areas of developing countries which improve the livelihood for women empowerment and gender equality (Anonymous, 2017a) and is considered being a lucrative industry with high employment potential (Popescu, 2018). Karnataka is one of the leading mulberry sericulture producing states followed by Andhra Pradesh, Tamil Nadu, West Bengal and Jammu & Kashmir which collectively contributes for about 98.5 per cent of silk production in the country. In developed countries at present there is a huge consumption of silk products which leads to high demand in the global level market and plays an important role in foreign exchange earnings for developing countries in the world that have resulted in the transformation from sericulture sector to the manufacturing sector. Silk producing countries in the world are : China, followed by India, Uzbekistan, Thailand and Brazil (Anonymous, 2017b). Compound annual growth model was used to assess mulberry area and silk cocoon production in India from 1971-72 to 2008-09 (Manjunath *et al.*, 2015). Regression analysis aims to study the relationship between silk cocoon production and time periods and is used to estimate trends of silk growth in India (Bhat *et al*., 2014).

The silk industry of Kashmir gained a leading position on Europe silk route with which Kashmir had started its silk trade and exports silkworm seeds to Europe (Anonymous, 2013). Jammu and Kashmir produced about 801 metric tonnes of silk cocoons during 2018-19 with income generation under pre-cocoon and yarn production excluding value additions in silken fabric/ products sales (Anonymous, 2020a). In Jammu & Kashmir, mulberry is being cultivated in 7,064 hectares and produced 739 metric tonnes of cocoons and 112 metric tonnes of raw silk during the year 2009-10 (Trag *et al.,* 2011). Sericulture in Jammu & Kashmir having a temperate climate conditions for quality silk production, organized production system and supply of disease free laying eggs, value added products of sericulture activity, modernization of reeling sector, rationalization of silk cocoons marketing which gives a wonderful picture to the silk industry in the global silk markets (Bhat *et al*., 2020).

Silk Products have a ready market both at national and international levels; however this industry needs immediate attention by the Government to improve the socio-economic condition of weavers (Yousuf *et al.,* 2013). Silk Samagra was introduced by Central Silk Board Government of India for sericulture development in the Country including Jammu & Kashmir (J&K) with an objective to improve the quality and productivity of silk produced (Anonymous, 2019). A research study in Kashmir valley was conducted to assess the growth of sericulture which is not only an important income generating activities but also as the key contribution to the GDP of the union territory of J&K.

Material and Methods

Study Area

Kashmir lies in the north-western part of India which is located between Pir Panjal and Greater Himalayan ranges, a transverse valley and meso-geographical region in union territory of Jammu & Kashmir. According to census, 2011 the Population of Jammu & Kashmir is 1.25 crore people which accounts for about 1.04 per cent of the total population of the country with Literacy rate is 67.17 per cent. Nearly 70 per cent of population of J&K directly or indirectly depends on agriculture and allied activities like sericulture, apiculture that significantly contributes to the economy of J&K. Kashmir is well known for silk carpet weaving which is made up of both silk yarn and wool. Silk carpet design that attained great excellence due to superb artistry which inspired countries from central Asia. It led to the high demand in the international market and carpet weaving become a source of livelihood opportunity to the inhabitants of people of this region.

The present study is based on secondary sources of data which aims to examine time series data on mulberry area, production and productivity of silk cocoon in Kashmir valley from 1990-2020 which were collected from Directorate of Sericulture, Kashmir, Central Sericultural Research and Training Institute Pampore, Directorate of Economics and Statistics, Jammu and Kashmir and reports of Food and Agriculture Organization.

Sericulture development in Kashmir valley was evaluated through measuring growth in area of mulberry, production and productivity of silk cocoons. The compound annual growth rates (CAGR) of area under mulberry, production and productivity of silk cocoons were computed using the exponential growth function.

$$Y=\beta_0 \ \beta_0^t$$

$$\text{Log } Y= \log \beta_0 + \log \beta_1$$

Compound growth rate were calculated by using the following formula.

Where, CGR = Compound growth rate

t = time trend, denoting years

Y = Area/ production / productivity

β_0 = constant

β_1 = regression coefficient

Regression Model

To examine the impact of variation in time, taken as criterion variable on the outcome variables *viz.,* area of mulberry, production and productivity of silk cocoons, regression analysis was used to find the strength of association between dependent and independent variable which was used to find out trends and understand the relationship between variables. The variables considered for analysis are area of mulberry, production and productivity of silk cocoons. The dependent variable Y is area, production and productivity and Independent variable X is the time period (years). Among the models being fit the best model was selected on the basis of their goodness of fit of R^2 and significance of the coefficients.

Decomposition Analysis

To know the relative contribution of area and yield towards the total output, a decomposition model was used to examine the yield effect, interaction effect and area effect on the production of silk cocoons which enables to analyse the change in the production of a particular crop due to the increase of area or yield improvement (More *et al.,* 2015). The average area and productivity of first triennium was taken as a base and it was compared with the averages of last triennium in respective periods. In the decomposition analysis the total change in production was decomposed into three effects, yield effect, area effect and interaction effect due to change in yield and area by applying the function,

$$\Delta P = A_0 \Delta Y + Y_0 \Delta A + \Delta A \Delta Y$$

ΔP = Change in production.

A_0 = Area in the base year.

Y_0 = Yield in the base year.

Y_t = Yield in the current year.

A_t = Area in the current year

ΔA = Change in area ($A_t - A_0$)

ΔY= Change in the Yield ($Y_t - Y_0$)

Results and Discussions

Kashmir is one of the important silk cocoon producing union territory in India. Production and productivity of silk cocoons of Kashmir indicated accelerating linear trend when compared to trend of mulberry area. Area of mulberry shows decreasing trend in Kashmir valley which was 270 hectares in 1990-91 and reached 211 hectares in 2019-20. The production of silk cocoons in Kashmir which was 210 metric tonnes in 1990-91 reached 347 metric tonnes during the year 2019-20. The perusal of Table 1 shows that area under mulberry plantation has seen annual compound growth rate of -1.14 per cent from 1990-2020 which shows decelerating trend and negative growth rate. Production and productivity of silk cocoons has seen annual compound growth rate of 1.59 percent and 2.79 per cent indicating a positive growth rate from 1990-91 to 2019-20.

Table 1

Annual compound growth rate for Mulberry and Silk cocoons in Kashmir with respect to area of mulberry, production and productivity of cocoons from 1990-91 to 2019-20

Variable	CAGR (%)
Area of Mulberry	-1.14
Production of silk cocoons	1.59
Productivity of silk cocoons	2.79

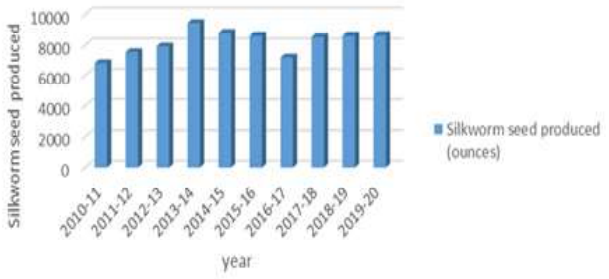

Fig 2 : Silk worm seed produced in Kashmir valley (Source: Directorate of sericulture, J&K)

The perusal of Table 2 reveals that silk cocoon production and productivity shows an increasing trend with respect to time and also indicates that there is significant relationship between time with production and productivity of silk cocoons which is significant at 0.05 level of significance. The results shows that 72.5 percent changes is explained by time variable in production of silk cocoons and 39.3 per cent changes is explained by time period in productivity of silk cocoons. It is observed that area of mulberry shows a decreasing trend with respect to time and also indicates that there is significant relationship between time and area of Mulberry and p-value was observed to be 0.012 which is less than 0.05 implying that there is significant relation between time period and area of mulberry and 14.2 per cent changes is explained by time variable.

Table 2

Regression analysis of Mulberry area, Production and Productivity of Silk cocoons in Kashmir valley

Independent Variable	Dependent Variable	R^2	Intercept	Slope of Regression line	P-value.
Time	Area of Mulberry	0.142	3.79	-2.62	0.012
	Silk cocoons production	0.725	1.42	6.26	0.035
	Silk cocoons productivity	0.393	0.30	0.03	0.028

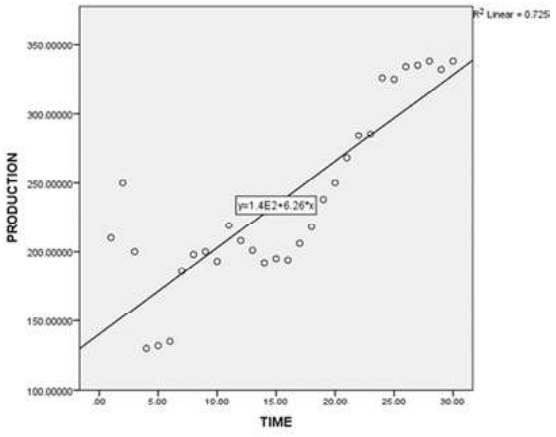

Fig 3: Trend in production of silk cocoons in Kashmir valley from 1990-2020

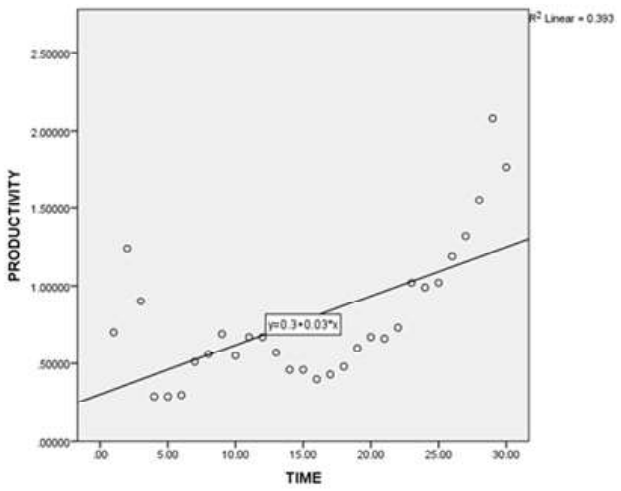

Fig 4 : Trend in productivity of silk cocoons in Kashmir valley from 1990-2020

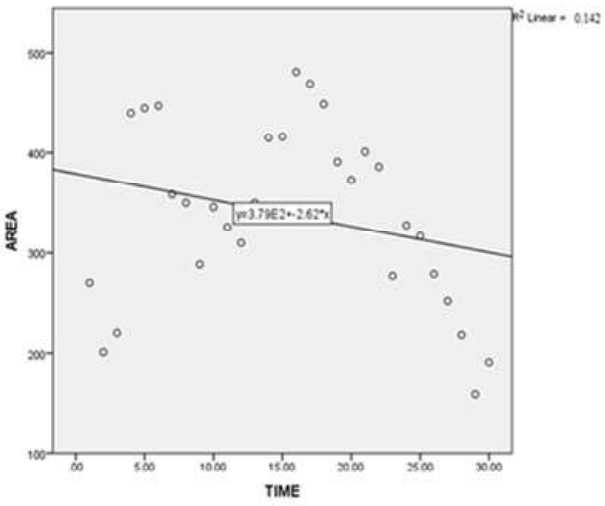

Fig. 5 : Trend in area under mulberry in Kashmir Valley from 1990 - 2020

The decomposition analysis of the silk cocoon production in the Kashmir valley is presented in Table 3. The perusal of the table reveals that increase in the production of silk cocoons is mainly due to the increase in yield from 0.77 in 1990 to 1.76 in 2020 having around (59.27 per cent) contribution to the total production of silk cocoons. The stagnation in area as discussed above is clearly reflected in model showing area has contributed only (-5.37 per cent) to the overall production of silk cocoons. The combined effect of the interaction between area and productivity has contributed (46.10 per cent) to the production of silk cocoons in Kashmir valley. The results clearly reveals that increase in yield of silk cocoons was the major factor in increased production of silk cocoons.

Increasing trend of silk cocoon production and productivity in Kashmir valley is due to high yielding varieties of mulberry, silkworm biovoltine hybrids, separate rearing sheds, effective management and implementation of training schemes and programmes (Hussain, 2002; Bhat *et al.*, 2020; Chauhan *et al.,* 2016 and Trag *et al.,* 2011). Mulberry area shows decelerating trend and negative growth rate due to improper plantation practices and land under horticultural and agriculture crop is under stress due to the reluctance of farmers towards growing of mulberry plants in their land. For this reason intercropping of mulberry with agriculture and horticulture crops for sustainable livelihood is the answer to address leaf shortage and to promote sericulture in Kashmir valley (Ahsan, 1989; Mir *et al.,* 2018 and Qadri *et al.,* 2021). Inadequate marketing of silk cocoons and poor extension support is one of the main cause which discourages the farmers to take or continue sericulture activities in Kashmir valley (Ganie *et al*., 2018 and Bhat *et al*., 2020) but now sericulture is in reviving phase of sericulture which encourage farmers and stakeholders to involve in this sector leading to sustainable development of sericulture (Anonymous, 2021).

TABLE 3

Decomposition analysis model of sericulture resource from 1990-2020 in Kashmir Valley

Variable	Base triennium	Ending triennium	Total value	% contribution prod	
Area of Mulberry (ha)	270	191	Area effect	-50305.1	-5.37
Silk cocoon Prod. (mts)	210	338	Yield effect	554742	59.27
Silk cocoon Yield (mts)	0.77	1.76	Interaction effect	431466	46.10

In 2010-11, union territory Govt. of J &K wanted up-gradation of departmental nurseries to improve mulberry saplings and leaf production which encouraged and supported the farmers stakeholders to take up sericulture and taking up multi-cropping. This was done by providing appropriate incentives and crafted public private partnership model to promote silk tourism. This is likely to support all the stakeholders in the value chain and play an important role for socioeconomic development of the study region (Anonymous, 2020).

Sericulture development in Jammu and Kashmir reveals that the production and productivity of silk cocoons has positive growth rate due to the plantation of improved mulberry varieties. Further Jammu & Kashmir sericulture is based on adaptation of technological innovations from different sericulture institutions and tree type mulberry plantations support the farmers to raise successful cocoon crop and produce silk yarn. Rearing kits should be provided to the farmers to help them conduct rearing on modern scientific lines and increase their average productivity per ounce of the seed. Apart from decreasing trend in the area under mulberry due to improper plantation practices, insufficient mulberry leaves, problems in marketing discourages the farmers to remain in sericulture. A strategic comprehensive approach and human resource development and effective supply chain collaborations is required at both pre-cocoon and post cocoon sectors which should be addressed simultaneously. Sericulture has the potential to provide viable and sustainable livelihood opportunities which includes a number of processes including backward and forward linkages which perfectly aligns with the National Goals and the sustainable development goals of United Nations that play an important role in poverty alleviation and inclusive sustainable growth. Mulberry plantations creates natural carbon sink which mitigates climate change and prevent environmental degradation and promotes sustainable livelihood. Therefore by effective management and need for formulation of area stabilizing policy is required for encouraging silk farming and sustain the livelihood of sericulturists.

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