SERICULTURE AND ENVIRONMENT ARE COMPLEMENTARY: PLANTATION OF IMPROVED MULBERRY GENOTYPES AT DIFFERENT ALTITUDES OF HIMANCHAL PRADESH

Rajat Mohan et al.

Environment
Forestry
Sericulture
Mulberry
Genotypes and tree

RAJAT MOHAN*, RANJAN TEWARY1, ANIL DHAR2 SARDAR SINGH3, M. M. BHAT AND
M. A. KHAN4
Regional Sericultural Research Station, Sahaspur, Dehradun - 248 197
1Scientist-C, Research Extension Centre, Una, H.P.
2Scientist-D, CSR and TI, Pampore, J and K
3Scientist-C, Presently at, Cluster Development Centre, Hamirpur, H.P.
4Director, CSR and TI, Pampore, J and K
E-mail: drrajatmohan@yahoo.co.in

ABSTRACT

Good mulberry genotypes if screened and adopted as forestry and social plantation may serve to
enrich the forestry, environment as well as may be a tool to develop sericulture industry. Hence,
seven mulberry genotypes were screened by growing as trees at different altitudes viz 1000’,
2900’ and 4200’ AMSL at three sites in Himanchal Pradesh. The plantation done are rich source
of improved mulberry genotypes as germ plasm and may be used to multiply the recommended
genotypes for plantation at farmers and farm/forest level. Improved mulberry genotypes viz S-
146, S-1, S-13, S-34, S-1635, TR-10 and K-2 were planted in Jan 05 at three altitudes viz:
Takarla farm of REC Una 1000’ AMSL, Dagwar DOI, HP farm 2900’ AMSL and DOI HP
farm Palampur 4200’ AMSL. The data showed clear difference at each site. The data on survival
showed 95-98 % survival at Takarla (1000’ AMSL) and Palampur (4200’ AMSL) and 85 %
survival at Dagwar farm (2900’AMSL). It was observed that S-1635 and S-146 showed highest
leaf yield (7-10 t/ha/year) at all the three altitudes followed by others. The paper deals with
recommendations and package of practices to be followed for plantation.

*Corresponding author
INTRODUCTION

India has been doing sericulture for many centuries and the Indian silk has been popular among rulers and the masses. The Indian history and ancient literature for example Ramayan find a mention about silk. During the pre independence period even the English rulers also promoted the industry. Immediately after independence the Govt. of India paid attention to the industry and the Central Silk Board was created in 1948 by an act to cater to the needs of over all development of sericulture in the country. The host plants growing in the forests and the cultivated plants of farmer’s farms form the food plants for different kinds of silkworms producing variety of silk. Sericulture can play an important role in development of Forests and environment as well through plantation of mulberry trees.

The hilly topography, socio-economic condition of the people, agro-climatic condition of the state and also availability of the natural resources like water, forest, climate and natural mulberry wealth favour the development of sericulture in Himanchal Pradesh. Sub-tropical and temperate both climates exist with severe winters. Agriculture is almost rainfed. The climate of the pockets of plains and hills is very congenial particularly for sericulture. It is in majority hilly state with altitude ranging from (1000 – 20000) feet AMSL. The temperature varies from 40 degrees Celsius in the plains during summer to minus 20 degrees Celsius in the Alpine zone during winters. The State experiences a rainfall ranging from 1500 to 1700 mm in outer Himalayas. The altitude range suitable for silkworm rearing is between 1000-4500’ AMSL.

The monsoon rains are normal, 80 percent of the total annual rainfall is received between June – September. More than 90 percent of total population directly or indirectly depends upon agriculture and allied activities for livelihood. Sericulture can be a good tool for livelihood as well as to enrich the environment. Himachal Pradesh has wide variety of soils found in its valleys and tracts. Soil changes from place to place and it changes the nature and type of vegetation it supports. Soils found in Himachal Pradesh vary from rich deep alluvial soil to the thin and bare soils of the high mountains.

The mulberry wealth is mostly in the form of trees of the local variety, scattered around the dwelling units, on bunds of farmers field i.e. along the periphery of agricultural fields. On an average, the beneficiaries have 50 to 100 mulberry trees. Mulberry leaf is harvested once in March-April in sub-tropical areas for rearing purposes and then in September for autumn crop. Thus the trees are disturbed only twice in a year for sericulture purpose making them good trees under agroforstry. (Dhar and Khan, 2005; Dzhafarov and Gadzhiev, 1972)

Further, reasons identified for the low rearing capacity and productivity of the sericulturists in the state are the scattered nature of the mulberry trees and most of the mulberry trees are of local variety, hence, the leaf yield per tree is low. The forests if developed in an organized form with improved mulberry varieties will provide leaves to the adjacent villages and will also enrich the forest with mulberry. The pruning resorted twice in a year will provide twigs as fuel and the same can be used to prepare baskets and can give additional revenue. Even leaves harvested can be sold on nominal rates to farmers which will provide revenue to the forests. Further the fruits of mulberry trees can be exploited to further add to the income by production of Jam and squash and can be source of income for poor farmers.

Therefore it was felt essential to establish Germplasm of few high yielding genotypes at threes sericulturally potential altitudes so that improved genotypes are multiplied and planted both at Govt farm and in farmer’s field to harvest qualitative leaves with higher yield. These mulberry forests / plantation can contribute to both one as a potential tree for afforestation and secondly its leaves can serve as food plant for development of sericulture in adjoining villages.

MATERIALS AND METHODS

The quality and quantity of the silk is directly dependent on the quality of mulberry leaf which influences the healthy growth of silkworm larvae thereby positively affecting the overall cocoon production. Since it is
established fact that the quality mulberry foliage plays the most important role for the better crop yield, it becomes absolutely necessary to improve by replacing the old and local varieties with new improved ones. One genotype performing better at a place may not perform well at other place and hence it is very important to have trials for each region/ecozones/altitudes so that variety suitable for particular place/altitude is identified.

**Location of Experiments:** The project was taken up at the following sites:

i) DOI, HP farm Takarla (1000’ AMSL), Distt Una
ii) DOI, HP farm Dagwar (2900’AMSL), Dharamshala, Distt: Kangra
iii) DOI, HP farm Palampur (4200’AMSL), Distt Kangra

Hence seven improved genotypes and three different altitudes were selected in Himanchal Pradesh for the trial. The selection of genotypes was based on the trials conducted in other regions and states.

The mulberry saplings of the seven improved genotypes viz: S-146, S-1, S-1635, S-34, S-13,TR-10 and K-2 raised in nursery at Una were planted in RBD design at three different locations viz: DOI HP Takarla farm(1000’ AMSL), DOI HP Una, farm Dagwar (2900’AMSL), Dharamshala, Distt: Kangra and DOI HP farm Palampur (4200’AMSL), Distt Kangra in 2005 January.

**Experimental details/design is as under**

No of genotype: 07(S-146, S-1, TR-10, S-34, S-13, S-1635 and K-2)

No of trees/plants per Variety : 12
Training : Tree (Crown 5’ 1/2’ feet)
Replication : Three
Spacing : 8’x8’feet
Design : RBD

After the establishment period of three years the growth observations were taken for six seasons in two years. Normal standard recommended package of practices were given regularly.

**RESULTS**

The data on survival showed 95-98 % survival at Takarla(1000’AMSL) and Palampur (4200’ AMSL) and 85 % survival at Dagwar farm (2900’AMSL) (The high survival was due to the fact that one year old saplings were used at the time of plantation as the genotypes were to be grown as trees). The data collected during 2009 showed that S-1635 and S-146 recorded leaf yield at par and are higher than other varieties. The leaf yield per year per tree in three harvests were 7.37 kg , 7.34 kg , 5.89 kg, 5.06 kg , 4.53 kg ,5.66 kg and 4.03 kg respectively in S-146,S-1635,, S-34, S-13, S-1, TR-10 andK-2 at Palampur.Similar pattern was found at 1000’ and 2900’, AMSL at Takarla and Dagwar respectively with lesser values in comparison to Palampur. The data showed that leaf yield was highest at Palampur (4200’AMSL) followed by Takarla (1000’AMSL) and Dagwar (2900’ AMSL) (Table 1 and Figs. 1 to 4)

S-1635 is recommended for plantation in HP along with S-146. This will provide stability to sericulture Industry in the state. After about five years of plantation 6-10 ton/hectare leaves can be harvested based on the altitude, soil and climatic conditions. The plantation of trees should be preferably kept under irrigated conditions up to five years and afterwards they can be maintained under rainfed conditions. This will provide better survival and growth. Recommended pruning and package of practices should be followed for expression of full potential of the genotypes.

Besides, S-1635 and S-146 the other genotypes viz TR-10, S-34, S-13 and S-1 form a gene pool of improved mulberry genotype. The gene pool raised under this project at Takarla, Dagwar and Palampur are rich source of these genotypes and will serve as germplasm for further studies and the germ plasm needs to be maintained. S-13 and S-34 can be grown in water stress conditions. S-1 and TR-10 is very good for late age rearings. Even K-2 genotype which showed lowest yield is useful variety and is in demand for chawkie
rearing by expert sericulturists. K-2 can be grown in chawkie gardens for departmental use during chawkie rearing.

The trees after full growth will provide 20-30 kg of leaves per tree/year in three harvests and a unit of 100 trees will yield 2500-3000 kg of leaves which are sufficient to rear 200-300 dfls of chawkie reared worms and will lead to production of 100-150 kg of cocoons worth Rs 10000-15000 @ 50 kg of cocoons /100 dfls in three crops. Each crop will take only 20 days and the related works can be done by ladies and children in their leisure time. 100 trees can be planted by poor farmers on the bunds/peripheri of their farms and also in the vicinity of their houses without involving their main land holdings. The rearing involves nominal expenditure. However, forests can do a miracle by adopting all the seven genotypes as forestry trees as these will form very good species for afforestation programme and will also support sericulture industry which provides livelihood to poor farmers and many more in different phases i.e. from cocoon production to reeling (production of yarn) fabric production and garment business.

The data on plantation showed that all the seven mulberry genotypes are suitable for plantation in forests, van panchayat land, waste land and in farmers field. Thus the germplasm of the seven improved mulberry genotypes raised at DOI HP Takarla farm (1000’ AMSL), DOI HP farm Dagwar (2900’ AMSL) and at Palampur farm (4200’ AMSL) are a rich source of genepool for further multiplication and plantation at farmers level. (Machii and Katagiri, 1991; Machii; et al., 1997, Rahman, et al., 1994 and Yokoyama, 1975)
DISCUSSION

High leaf yield recorded in S-146 and S-1635 variety in the present study is corroborated with the work of (Dwivedi et al., 1988, 1989) who reported that the leaves of the variety were thick, coarse, dark green in colour and larger in size and also recorded highest leaf weight and water content. Rahman et al., (1994 and 1999) reported that the variety showed faster growth rate associated with higher values of leaf yield per unit area. Accordingly in the present study S-146 and S-1635 varieties are recommended for plantation between 1000-4000’ AMSL in H.P. and in similar conditions in other states.

Transfer of technology

During December 2009 a total of 6.67 tonnes improved mulberry cuttings of improved mulberry genotypes were supplied to DOI HP by RSRS, Sahaspur and ZSSO, Dehradun as per the details given below:

S-146 : 2.2 ton, S-1635: 3.57 tonnes, TR-10: 0.1 ton, S-13:0.1 ton, K-2: 0.8 ton. The above cuttings were planted in different regions of H.P. by the Directorate of Horticulture H.P. However, the feed back from

<table>
<thead>
<tr>
<th>Genotype</th>
<th>Season</th>
<th>Site Takarla (1000’ AMSL)</th>
<th>Site Dagwar (2900’ AMSL)</th>
<th>Site Palampur (4200’ AMSL)</th>
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<tbody>
<tr>
<td></td>
<td>Leaf Yield %</td>
<td>Leaf yield / tree</td>
<td>Leaf Moisture %</td>
<td>Leaf yield / tree</td>
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<tr>
<td>S-146</td>
<td>Spring 73.13</td>
<td>1.97</td>
<td>72.15</td>
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<tr>
<td></td>
<td>Summer 69.66</td>
<td>1.56</td>
<td>70.37</td>
<td>1.33</td>
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<td>Total 71.7</td>
<td>1.73</td>
<td>70.70</td>
<td>1.41</td>
</tr>
<tr>
<td>S-1635</td>
<td>Spring 73.31</td>
<td>1.98</td>
<td>72.39</td>
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<td>Summer 70.26</td>
<td>1.6</td>
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<td></td>
<td>Total 72.35</td>
<td>1.73</td>
<td>72.15</td>
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<td>S-34</td>
<td>Spring 72.28</td>
<td>1.94</td>
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<td></td>
<td>Summer 67.29</td>
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<td></td>
<td>Total 70.91</td>
<td>1.58</td>
<td>70.05</td>
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<td>S-13</td>
<td>Spring 73.91</td>
<td>1.61</td>
<td>71.93</td>
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<td></td>
<td>Summer 67.27</td>
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<td></td>
<td>Total 69.91</td>
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<td>71.34</td>
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<td></td>
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<td>1.37</td>
<td>69.34</td>
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<td>Total 70.35</td>
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<td>70.14</td>
<td>1.25</td>
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<td>TR-10</td>
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<td>1.85</td>
<td>72.99</td>
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<td></td>
<td>Summer 69.31</td>
<td>1.53</td>
<td>70.27</td>
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<td></td>
<td>Total 71.84</td>
<td>1.67</td>
<td>71.55</td>
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<td>K-2</td>
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<td>1.37</td>
<td>69.8</td>
<td>0.9</td>
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<td></td>
<td>Summer 68.77</td>
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<td>68.51</td>
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<td>Total 70.67</td>
<td>1.40</td>
<td>70.03</td>
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<td>CD at 5 % level</td>
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Table 1: Leaf yield and leaf moisture data at three altitudes in three seasons

CD at 5 % level

<table>
<thead>
<tr>
<th>Season</th>
<th>Site Takarla</th>
<th>Site Dagwar</th>
<th>Site Palampur</th>
</tr>
</thead>
<tbody>
<tr>
<td>Leaf Yield</td>
<td>0.16</td>
<td>0.086</td>
<td>0.24</td>
</tr>
<tr>
<td>Summer</td>
<td>0.11</td>
<td>0.09</td>
<td>0.21</td>
</tr>
<tr>
<td>Autumn</td>
<td>0.11</td>
<td>0.09</td>
<td>0.19</td>
</tr>
<tr>
<td>Leaf Moisture %</td>
<td>0.66</td>
<td>0.74</td>
<td>0.71</td>
</tr>
<tr>
<td>Summer</td>
<td>0.67</td>
<td>0.43</td>
<td>0.38</td>
</tr>
<tr>
<td>Autumn</td>
<td>1.14</td>
<td>0.50</td>
<td>0.50</td>
</tr>
</tbody>
</table>
the state Govt is awaited but even 40% survival out of these will add greater dimension to the sericulture industry and environment of H.P.

**Package of practices for these genotypes**

These genotypes can be grown on a wide range of soil ranging from pH 6.5-7.5. High. These genotypes can be easily multiplied in nursery by cutting with 3-4 active buds obtained from at least 6 months old branches. These genotypes have more than 90% survival through plantation of one year old saplings. Nursery can be raised in December/January and in July/August. Nursery in Dec/Jan is subject to availability of assured irrigation.

**Planting season:** In the rain fed area the June/July is the best planting season for raising plantation. The December/January can also be a good season provided assured irrigation is available. However, backup saplings of same age should be maintained in nursery for gap fillings of mortality, if any. In case of tree plantation the saplings should be of one year. Six-month-old saplings are used for plantation as bush.

**Spacing:** Tree type: 8x8 feet (can vary as per land availability i.e. between 6 to 10 feet for tree type plantation.

**Nutrient management**

**FYM:** Under rainfed conditions FYM /compost should be given @ 10 MT/ha/year and @ 20 MT/ha year in irrigated conditions

**Chemical Fertilizers**

**First Year:** N: P: K Kg/ha/year @ 50: 25: 25 in rainfed and irrigated both the conditions

**Second year onwards:** N: P: K kg/ha/year @ 100: 50: 50 in rainfed conditions and in irrigated conditions it should be 150: 75: 75 kg/ha year and in both the cases these may be applied in two split doses.

**Pruning:** Twice in a year : Bottom pruning in June/July 6-12’’ from crown and middle pruning in December/January: 2-3’ from crown.

**Plant protection:** Due to adoption of the practice of two seasonal pruning the chance of attack of disease and pests are very less. Some sporadic incidence may occur which do not cause economic damage. The pests are not found at threshold level. However, the fungal diseases can be controlled by 0.2% Bavistin with 15 days safe period. The pests may be checked by DDVP 0.2% solution with 15 days safe period.

**REFERENCES**


