Sericulture-based agroforestry systems for hilly areas of north-east India

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Abstract. Sericulture-based agroforestry systems (AFS) have great potential for higher returns in the north-eastern region with sloping and valley-land conditions. A field investigation was initiated in November, 1992 at Research Farm, Barapani (980 m above msl, 26°N and 92°E and average rainfall 2428 mm/year) on acid Alfisol. Seven mulberry (Morus alba L.) varieties, seven silkworm breeds and rearing performance of a bivoltine breed, NB-18 were evaluated in different trials. Three sericulture-based AFS viz. sericulture with 1. fruit trees and fodder grasses, 2. field (upland) crops, and 3. lowland rice were developed at the Research Farm. Mulberry varieties TR-4, S-1635 and TR-10, and NB-18 – a bivoltine silkworm breed were found better suited for this region. Sericulture with field crops (French bean-groundnut-mustard/vegetables) for valley land, with fruit plants (guava, pineapple) and grasses for mid-hill situations, and with rice for low lands were found suitable at the Farm and for possible adoption in the north-eastern hill region of India.

Introduction

Shifting cultivation and deforestation are major constraints in developing sustainable food-production systems in the north-eastern hill region, due to their detrimental effects on soil and water resources (Borthakur et al., 1985; Singh et al., 1994). At the same time the region has some excellent indigenous resource-based land use systems. Most of them are tree based, having unique fertility restoration capacity by preventing soil loss, improving soil organic matter status and replenishing the nutrients through effective recycling mechanism (Chauhan and Dhyani, 1989; Dhyani and Chauhan, 1994; Singh and Dhyani, unpublished). Sericulture is yet another vocation being practised since time immemorial as a part time occupation in this region (Gargi et al., 1994). This is mainly because the farmers lack systematic block plantation of mulberry, and also crop production for self consumption is their first priority. Moreover, farmers continue to rear multivoltine silkworm breeds which are hardy, but inefficient than the frailer but more productive bivoltine strains. Considering agroforestry as a viable solution to tackle the problem of shifting cultivation (Dhyani and Singh, 1995), sericulture could
be combined as one of its component. Hence, nine AFS as models, including three sericulture-based systems, were designed and evaluated for their productivity and sustainability. The paper evaluates three sericulture-based systems for their suitability under identical soil and climatic conditions and possible adoption in this region.

Materials and methods

A collaborative project between the Indian Council of Agricultural Research (ICAR), Research Complex for north-eastern Hill Region and Central Silk Board was initiated in May 1993. The experiments were laid out at ICAR Research Farm, Barapani (980 m above msl, 26°N and 92°E) in Meghalaya, India on acid Alfisol. The area receives an average rainfall of 2428 mm yr⁻¹. The systems were developed in 3 ha area distributed on foot hills (2 ha) with 30–48% slope and in valley land situations (1 ha). The project aims at the development of land use technologies based on sericulture under different AFS for this region.

To find out suitable varieties of mulberry (*Morus alba* L.) for hills, six high yielding varieties (HYV) viz. TR-4, TR-10, BC-259, S-1635, C-763, Kanva-2(K-2) and one local were planted at 0.9 x 0.9 m spacing in 3 replications during May 1993. There were 51 plants in gross plot and 15 in net plot. Growth parameters such as plant height, number and length of primary and secondary branches, and leaf yield (fresh weight) were recorded at the time of leaf harvests during November 1993, April, June, August and November 1994.

'Voltinism' or the natural breeding frequency of the worm varies from twice a year in the case of bivoltines, found only in temperate climates, to several times a year with multivoltines. Bivoltines produce yarn of greater uniformity and neatness and is thus preferred. With the advent of artificial hatching and improved rearing techniques, a number of bivoltine strains well acclimatized to different agro-climatic regions are now available (Datta, 1992). In the present study, seven improved breeds comprising bivoltine and *B₁ × B₁* hybrids viz. NB-18, KPG(A), KPG(B), P₅, J-112, NB-18 × P₅ and P₅ × KPG(B) were evaluated. The first four breeds are pure bivoltine races of Indian origin, and NB-18 × P₅ and P₅ × KPG(B) are the hybrids developed at Regional Extension Centre, Shillong (Meghalaya). J-112 is a Japanese race. KPG(A) and KPG(B) races were developed at Regional Sericulture Research Station, Kalimpong (West Bengal). Hatching percentage of silkworm eggs, effective rate of rearing (ERR/10,000 larvae) by number and weight, and silk ratio were calculated by using the following formulae;

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\text{Hatching \%} = \left( \frac{\text{Total number eggs hatched during brushing}}{\text{Total number of eggs in layings}} \right) \times 100
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