1. INTRODUCTION

The world population is projected to exceed 7.5 billion by the year 2020 and the Indian population 1.4 billion by the year 2025. To keep pace with the population growth and to face the two related challenges of agriculture, i.e., increasing crop productivity and profitability of farming, many high yielding varieties with suitable production technologies were introduced. During 1960s, with a view to increase productivity of crops, heavy doses of chemical fertilizers and high yielding crop varieties and hybrids were introduced, which resulted in what is popularly called ‘Green Revolution’. However, the benefit of Green Revolution did not last long and started expressing concerns about the long-term sustainability of agriculture (Gruhn et al., 2000). According to Rao and Reddy (2002), the important technological components for long-term sustainable agriculture are (i) reduced use of chemical-based inputs, (ii) increased use of organic manures, (iii) biological nitrogen fixation, (iv) soil and water conservation practices, (v) crop rotation, (vi) biological pest control, etc. Within the crop genetic potential, higher yields of crop plants could be realized under favourable crop environmental conditions, especially the soil fertility status.

Soil fertility may be defined as the ability of soil to provide all the essential plant nutrients in available form and in right quantity at right time. The soil fertility not only depends on its chemical composition but also on the quantitative and qualitative nature of the microorganisms available in it besides its physical properties (Subba Rao, 1986). In maintaining soil fertility and crop productivity, the two important plant nutrients, viz., nitrogen (N) and phosphorus (P) play a significant role. Nitrogen is highly mobile and subject to losses by both volatilization and leaching (Lyon, 1952), while phosphorus is quickly fixed in tropical soils and become
unavailable to plants (Hayman, 1975; Brady, 1985). Further, the agronomic strategies adopted in one crop often influence the nutrient needs of succeeding crops due to carry over effects. In order to reinforce the nutrients removed by the plants and to realize the fullest benefit of the farmyard manure (FYM) and the commercial fertilizers, an integrated approach was adopted, which included raising of legumes, maintenance of good tillage, weed elimination, soil erosion control, etc.

India being a tropical country and following the decline of many traditional management practices, soil fertility has been reduced due to oxidation loss of organic matter in the soil. Unless the soils are replenished with all the nutrients taken up by the crops, there will be persistent nutrient exhaustion posing a great threat to sustainable production. Added to this, the over and under application of chemical fertilizers and poor management of on-farm resources have damaged the environment, particularly soil and water which are the two most important capitals of all agricultural activities. Though the application of chemical fertilizers brought about manifold increase in crop production, the hazards associated with the chemical farming are being sidelined. In spite of growing awareness among the farming communities about the potential threat of continuous chemical based farming, the beneficial effects of various organics such as green manures, biofertilizers, compost, and vermicompost are not highlighted adequately, especially in mulberry which is grown for green biomass. In this context, the “Integrated Nutrient Management Approach” (INMA) is the science and philosophy of reversing the ill effects arising from soil mining of nutrients to promote sustainable agriculture (Siddaramappa, 2004). Also due to escalation of fertilizer price, integrated nutrient management (INM) approach would be more remunerative for getting higher returns with considerable fertilizer economy in a sustainable manner.
Sericulture in India is an age-old avocation of farmers and the country stands second, next only to China in the production of raw silk. India’s raw silk production in 2005-06 was 17035 MT. This is against the actual demand of about 26,000 MT (Anonymous, 2006). Though sericulture is practised in diversified areas in more than 12 states, Karnataka has the maximum mulberry cultivation area of 88,903 ha (45.71%), production of 1287.14 lakh disease free layings (dfls) (43.18%), 55,881 MT reeling cocoons (43.57%), and 6,760 MT of raw silk (46.24%) production (Anonymous, 2003 a).

The production of high grade raw silk (2A and above) by silkworm (Bombyx mori L.) is possible only by rearing bivoltine silkworm, for which the prerequisite is good quality of feed. Mulberry leaf (Morus alba L.), the sole feed of B. mori, is a major economic component in sericulture as the quality and quantity of leaf produced has a direct bearing on cocoon production and its economics. R & D efforts during the recent past have led to improvement in the mulberry leaf yield through Victory-1 (V1) variety to about 60 MT from a mere 25 to 35 MT per hectare per year in the varieties that were used earlier (Dandin et al., 2003). During this period, a new thrust was given to irrigated mulberry where intensive cultivation could be practised with very high returns. However, the productivity of mulberry at this rate may pose a threat to the soil fertility, as this would remove enormous quantity of soil nutrients through high biomass production.

The inputs recommended for mulberry under irrigated conditions are at the rate of 20 MT/ha/yr FYM and 300:120:120 kg Nitrogen, phosphorus, and potash (NPK) fertilizers /ha/yr for Kanva-2 (K2 / M3) variety (Krishnaswami, 1986) and 350:140:140 kg NPK fertilizers /ha/yr for V1 mulberry variety (Kawakami and Yanagawa, 2003). These recommended levels are quite high and application by some
farmers even exceed these levels. Recent study conducted in Kolar District, Karnataka, revealed excessive use of chemical fertilizers, especially nitrogen to the extent of 6 to 23% (Jaishankar and Dandin, 2005). Further, continuous and indiscriminate use, and improper selection of fertilizers, especially nitrogen, also reduces greatly the fertilizer use efficiency and economic crop production. Of late, mulberry gardens have started manifesting the signs of low organic carbon and gradual shifting of soil pH from neutral to alkaline and alkaline to highly alkaline conditions. Increase in soil pH also resulted in widespread deficiencies of both macro-nutrients and micro-nutrients (Krishna and Bongale, 2001). Thus, it is a major concern drawing the attention of the scientists and farmers to improve the quality of soil through recycling of sericultural and farm residues and using the compost and other organic manures under INM practices. Further, the use of expensive commercial fertilizers as per requirement of crop is not easily affordable by the average farmers. Thus, it is imperative to know the farmers’ socio-economic conditions and their impact on the adoption level of improved sericultural practices.

To accomplish sustainable sericulture through INM, it is highly essential to use chemical fertilizers judiciously, apply adequate quantity of organic manures, use biofertilizers of good quality, and adopt them in an integrated manner. In the past, green manuring was an integral part of any agricultural system including mulberry cultivation, which assumed less importance following the advent of chemical fertilizers. The role of various biofertilizers in different agricultural and horticultural crops has been well documented by Bagyaraj (1996) and Balasubramanian (1996). The use of biofertilizers, viz., *Azotobacter*, phosphate solubilizing microorganisms (PSM) and vesicular arbuscular mycorrhiza (VAM) in mulberry cultivation has been found to be highly essential to rejuvenate soil fertility. The impact of biofertilizers,
either singly or in combination, on mulberry leaf and silkworm cocoon yield has been
proved beyond doubt in the field. However, there is an urgent need for the integration
of all the plant nutrition supply systems, especially under farmers’ field conditions,
with reduced doses of chemical fertilizers. The INM approach may, therefore, ensure
effective supply of plant nutrients, especially nitrogen, phosphorus, and potassium,
besides improving the fertilizer use efficiency. The nutrient content, and its better
uptake and efficient utilization by the mulberry crop has a significant role in
augmenting the growth and yield.

In the light of the above and the importance of the current topic in relation to
present day situation and the growing need for maintaining the soil health and fertility
for sustainable sericulture, the present investigation was undertaken with the
following objectives:

1. To work out a suitable blend of organic and inorganic nutrients for
   enhanced yield and quality of mulberry,

2. To achieve sustainable mulberry leaf and silkworm cocoon production at
   farmers’ level through soil fertility management, with emphasis on
   minimizing environmental pollution,

3. To monitor the build-up of soil health and soil fertility,

4. To economize the expensive chemical nutritional inputs in mulberry
   cultivation, and

5. To accomplish sustainability in farmers’ income and to improve farmers
   socio-economic needs from sericulture.