INTRODUCTION

Man is always inquisitive for Silk products. Silk – The Queen of textiles spells luxury, elegance, class and comfort. Mankind has always loved this shimmering fiber of unparalleled grandeur from the moment. Chinese Empress Shilling Ti discovered it in her tea cup. It withstood many a daunting challenges from other natural and artificial fibers and yet, remained the undisputed “Queen of Textiles” since centuries. Exquisite qualities like the natural sheen, inherent affinity for dyes and vibrant colors, high absorbance, light weight, resilience and excellent drape etc. have made silk, the irresistible and inevitable companion of eve, all over the world.

Chemically speaking, silk is made of proteins secreted in the fluid state by a caterpillar, popularly known as ‘Silkworm’. These Silkworms fed on the selected food plants and spin cocoons as a ‘protective shell’ to perpetuate the life. Silkworm has four stages in its life cycle viz., egg, caterpillar, pupa and moth. Man interferes this life cycle at the cocoon stage to obtain the silk, a continuous filament of commercial importance, used in weaving of the dream fabric.

Silk is a high value but low volume product accounting for only 0.2 % of worlds total textiles production. Silk production is regarded as an important tool for economic development of a country as it is a labour intensive and high income generating industry that churns out value added products of economic importance. The developing countries rely on it for employment generation, especially in rural sector and also as a means to earn the foreign exchange.

The history of the silkworm, which is also the story of silk, goes back to ancient times in China. Some of the stories have been handed down through the generations and are probably based party on fact and partly on legend and myth. The tale which persists is that about 2,640 B.C. a Chinese empress, Si-Ling-Ti, was watching the glistening
amber cocoons that little worms were spinning in the mulberry trees in the palace gardens. She unwound one of the threads on a cocoon and found that it was one, very long strand of shiny material. Fascinated, she pulled strands from several cocoons through her ring to form a thicker thread. Eventually, with the help of her ladies of the court, she spun the threads into a beautiful piece of cloth to make a robe for the emperor, Huang-Ti. This magnificent material, silk, became known at the "cloth of kings". The Chinese kept the secret of how silk was made for 2500 years. The material was sold to the rulers of the West, but the source of the shiny thread that made the material was not revealed. The penalty in China for telling that the silk came from the cocoons of the little silkworms was death! Some very strange ideas were formulated as to the origin of silk. Here are a few: Silk came from the colored petals of flowers in the Chinese desert, silk was made of wondrously soft soil, silk came from a spider-like animal that ate until it burst open and the silk threads were found inside its body, and silk came from the silky fuzz on special leaves. These ideas seem far-fetched today, but in ancient times they were serious theories.

Geographically, Asia is the main producer of silk in the world and produces over 95% of the total global output. Through there are over 40 countries on the world map of Silk, bulk of it is produced in China and India, followed by Japan, Brazil and Korea. India is the second largest producer of silk in the world, next to China, with 14.57% share in global raw silk production. The world production of raw silk as on 2010 is 1,40,051 MT’s (provisional). China produces 1,15,000 MT’s being the first in the world. India produced 20,410 MT’s of silk during 2010-2011, which is the second largest producer in the world. Brazil, Thailand, Uzbekistan and Vietnam are also producing silk around 4,423 MT’s in a year. India is the only country which produces all 4 varieties of silks viz., Mulberry, Tasar, Eri and Muga. India
produces around 4,050 MT’s of Vanya silks (Tasar, Eri, and Muga) in a year, which has very good market.

India has to import nearly 5000-6000 MT’s of bivoltine silk from China, especially for production of silk garments for export purpose. Since, the quality and function of the present raw silk production do not meet the country’s demand. The imported silk is mostly used as warp in the power looms and also in the handloom which indicated that Indian silk is not ideally suitable for warp in looms for production of fine quality fabrics. This given an idea of the future needs of Indian sericulture industry. The sericulture industry needs research and development support to increase the productivity and improve the quality.

India is agriculture based country majority population from rural area is totally depending on agriculture. Silk is a way of life in India. As the sericulture is an agro cottage based industry. It has been identified as an occupation of low investments high output source of employment and income. The industry holds high promise as an employment intensive occupation especially in rural and semi urban areas. Un-employment and under-employment continue to be the major problem of our country; it is more serious in rural areas. It is here that sericulture industry fit into our socio-economic condition as a tool for rural development (Benchamin and Jolly, 1987). Rural economy in India is largely dependent on agriculture. There is a considerable scope to increase employment and income in rural area through labour intensive remunerative enterprises like sericulture. Sericulture industry is unique in its advantages and suitability to the rural set up.

While India produces around 20,410MTs of raw silk annually (2010-2011), total annual consumption of silk in the country is around 29,300 MTs. It has a strong tradition and culture bound
domestic market of silk. In India, mulberry silk is produced mainly in the states of Karnataka, Andhra Pradesh, Tamil Nadu, Jammu and Kashmir and West Bengal and some non-traditional silk producing states like Maharashtra, while the non-mulberry silks are produced in Jharkhand, Chhattisgarh, Orissa and north-eastern states. There are four types of silk of commercial importance, obtained from different species of silkworms which in turn feed on a number of food plants. These are:

<table>
<thead>
<tr>
<th>Sr.No.</th>
<th>Common name</th>
<th>Scientific name</th>
<th>Food plant</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Mulberry</td>
<td><em>Bombyx mori</em></td>
<td><em>Morus alba</em> (L)</td>
</tr>
<tr>
<td>2</td>
<td>Tropical Tasar</td>
<td><em>Antheraea mylitta</em></td>
<td><em>Terminilia arjuna</em> and other</td>
</tr>
<tr>
<td>3</td>
<td>Muga</td>
<td><em>Antheraea assama</em></td>
<td><em>Litsea polyantha</em> and other</td>
</tr>
<tr>
<td>4</td>
<td>Eri</td>
<td><em>Philosamia ricini</em></td>
<td><em>Ricinus communis</em> and other</td>
</tr>
</tbody>
</table>

The bulk of the commercial silk produced in the world comes from this variety and often silk generally refers to mulberry silk. Mulberry silk comes from the silkworm, *Bombyx mori* L. which solely feeds on the leaves of mulberry plant. These silkworms are completely domesticated and reared indoorly.

Maharashtra, a state without a tradition of silk production, has a large gap between demand and supply of raw silk and more than 4,000 silk weavers in Yeola, Paithan, and Mohadi areas source their raw silk from neighboring states, amounting to a total value of ‘imports’ of Rs2,500 to 3,000 million (USD 50 to 60 million) per year. This demand for raw silk could become a source of rural employment within Maharashtra.
Introduction of sericulture was tried out in Maharashtra way back in the year 1959 by Maharashtra Khadi and Village Industries Board, and later by a separate Directorate, established by Maharashtra Government. However, these initial attempts to introduce sericulture were not successful and the industry did not expand to any significant extent in the state. The main constraints to sericulture in Maharashtra state were: lack of mulberry tree varieties adapted to local agro-climatic conditions, lack of suitable silkworm races, and lack of knowledge and skills among the farmers. Moreover, management practices were poor, leading to diseases and low productivity (30kg/100DFLS). In 2005 there were 3,000 families maintaining 4,200 acres of mulberry plantations spread over 1,004 villages of 20 districts in Maharashtra. In 2008, the number of families adopting sericulture had increased to 8,000 with over 10,000 acres of mulberry plantations, however with low DFL: Disease free laying, i.e. a bunch of approximately 500 disease-free silkworm eggs PPLPI Research Report 3 productivity (30kg/100DFL). Among the mulberry silk producing states in India, Maharashtra occupies the seventh position.

Maharashtra is India’s third largest state in terms of area of about 308,000 square kilometers and the second largest state in terms of population. As per 2001 census2, the population of Maharashtra state is approximately 96,752,000 resulting in a population density of 322.5 people per km². Over 64% of the population is employed in agriculture or agriculture-related activities. The area under irrigation is 33,500 km² (11%). Rice, jowar (sorghum), bajara (millet), wheat, oranges, grapes, bananas, mangoes and pulses are the important food crops. Cash crops include groundnut, cotton, sugarcane, turmeric and tobacco.

However due to international demand to sericultural product, Maharashtra Government is taking keen interest in this business.
Maharashtra has carved out a district place in the world of textile by virtue of its exquisite “Paithani” weaving known for extra ordinary craftsmanship; occupy a place of honor in the world of fabrics. The total area under mulberry plantation in Maharashtra state is 3811 acres with silk production of 7396 kg which generated employment for 19 thousand people in 26 districts of Maharashtra (Anonymous, 2000). A separate Directorate of sericulture at Nagpur has now been established in September 1997 to boost sericulture in Maharashtra.

Mulberry foliage is the only food for the silkworm (*Bombyx mori* L.) and is grown under varied climatic conditions ranging from temperate to tropics. Mulberry leaf is a major economic component in sericulture since the quality and quantity of leaf produced per unit area has a direct bearing on cocoon harvest. In India, most states have taken up sericulture as an important agro-industry with excellent results. (R.K.Datta, *Mulberry Cultivation and Utilization in India*)

The quality of mulberry leaves plays an important role in the success of the sericulture industry and directs its economics (Choudhury *et al.* 1991), and hence much effort and research have been carried out to improve the quality and quantity of mulberry-leaf production for silkworm rearing and then cocoon production. Some varieties of mulberry leaves appeared to be superior to others (Raman *et al.* 1995). The nutritional status of mulberry leaves can be improved by enriching them with extra nutrients to increase larval growth and improve cocoon characteristics (Sengupta *et al.* 1992).

Mulberry is a perennial tree of the family Moraceae and is economically important for its foliage as food and nutrients to the monophagous silk worm (*Bombyx mori* L.). Mulberry is believed to have originated on the lower slopes of the Himalayas (Sarkar, 1990). It can grow under various climatic conditions ranging from temperate to tropical. In India mulberry grows throughout the year due to favourable climatic conditions, making sericulture a full time
occupation. Since mulberry leaf production alone costs more than 60% of the total production cost of cocoons, the economic return in sericulture is largely determined by the amount of good quality mulberry leaves produced from a unit area (Das & Krishnaswami, 1965).

The *Bombyx mori* (L) is essentially monophagous and survives solely on mulberry leaves (*morus* sp.) which play an important role in the nutrition of the Silkworms, in turn cocoon and silk production (Nagaraju, 2002). The nutritional elements of mulberry leaves determine the growth and development of the larvae and cocoon production (Sridevi et al., 2005). The quality of the leaves has a profound effect on the superiority of silk produced by the *B. mori* (L). In this regard, the production of good cocoon crop is totally dependent on the quality of leaves. Leaves of superior quality enhance the chances of good cocoon crop (Ravikumar, 1988). It has also been demonstrated that the dietary nutritional management has a direct influence on quality and quantity of silk production in *B. mori* (Murugan et al., 1998). In recent years, many attempts have been made to improve the quality and quantity of silk (Hiware C. J. 2006), through enhancing the leaves with nutrients, spraying with antibiotics, juvenile hormone, plant products, with JH-mimic principles or using extracts of plants. Mulberry leaves have been supplemented with various nutrients for silkworm feeding to promote silk quality and quantity. The supplementation and fortification of mulberry leaves is a recent technique in sericulture research (Murugan et al., 1998). It has been reported that the vitamins of B-complex group and certain essential sugars, proteins, amino acids, minerals etc. are responsible for the proper growth and development of the silkworm, *B. mori* (Faruki, 1998). A number of researchers have worked on the effects of vitamin enriched food on the reproduction of *B. mori* females (Faruki et al., 1992; Saha and Khan, 1999).
Hence, in the present investigation an effort was made to study the effect of graded levels of NPK, FYM, Nitrogen (Urea) and Super light (Foliar spray) on Mulberry varieties like V-1 and S-1635 on black soils under Solapur (M.S) conditions with the following objectives:

1. Influence of application of graded levels of NPK, FYM, Nitrogen (Urea) and Super height (Foliar spray) on plant growth and yield components of V-1 and S-1635.

2. Influence of different spacings on the performance of the two Mulberry varieties V-1 and S-1635.

3. Influence of feeding mulberry leaves obtained by application of different fertilizer doses on silkworm growth, development and economic traits of silkworm *Bombyx mori* (L) race PM x CSR2.