CHAPTER I

INTRODUCTION

Teak (*Tectona grandis* L.f.) has centuries old reputation as the king of timbers. It is highly durable, easily worked, attractive, strong and relatively light. It has been used as both a structural and decorative timber in the temple, palaces and houses of the Indian sub-continent for perhaps 2000 years, where its durability has been proved. The wood is popular with priests, princes, carpenters and the common man, termites and fungi tend to shun it. Teak plantations are being established throughout the tropics as growers are attracted by the high prices that teakwood can fetch in global markets. The rotation lengths of these plantations vary from 20 to about 80 years but the trend is towards the shorter end of the time scale and short rotation plantation teakwood is entering the market in increasing volumes.

Timber, fuel wood, fodder, fruits and medicine are the major products from forestry and agroforestry. Among these, timber is of great commercial significance as it has greater relevance to trade situation. India has been importing timber and other forest produce for industrial and domestic purposes. The gap of 20 million m$^3$ of industrial timber between demand and production in 1997 is increasing rapidly and is projected to be around 110 million m$^3$ by 2090 in India (NRCAF 2007; Kareemulla *et al.*, 2005; Singh and Marzoti 1996). More than one thousand crore rupees worth of raw material is imported every year for meeting the demand of forest based industries in 1999 and it is likely to increase to twelve thousand crore rupees by 2010 (Singh and Kumar 1999).

Among timbers, teak holds the place which diamond maintains among precious stones and gold among metals. This is what Dietrich Brandis, the renowned German forester, observed about teak some 150 years ago. Since then, teakwood has been the standard against which the quality and utilization potential of other tropical hardwoods have been compared. The genus name ‘Tectona’ is derived from the Greek word tekton, which means carpenter; teakwood has long been considered the carpenter pride. But as the supply of teak shifts from natural forests to plantations, many would-be teak
growers are posing the question: will teakwood remain a star? We believe it will, although there are some uncertainties and challenges ahead.

Teak (*Tectona grandis*) is one of the world’s premier hardwood timbers, rightly famous for its mellow colour, fine grain and durability. It occurs naturally only in India, Myanmar, the Lao People’s Democratic Republic and Thailand, and it is naturalized in Java, Indonesia, where it was probably introduced some 400 to 600 years ago. In addition, it has been established throughout tropical Asia, as well as in tropical Africa (including Cote d’Ivoire, Nigeria, Sierra Leone, the United Republic of Tanzania and Togo) and Latin America and the Caribbean (Costa Rica, Colombia, Ecuador, El Salvador, Panama, Trinidad and Tobago and Venezuela). Teak has also been introduced in some island in the Pacific region (Papua New Guinea, Fiji and the Solomon Islands) and in northern Australia at trial levels.

Although relatively unimportant in terms of the volume of world timber production, because of its strength and aesthetic qualities teak is the tropical hardwood most in demand for a specific market of “luxury” applications including furniture, shipbuilding and decorative building components. It is thus of major importance in the forestry economies of its main producing countries.

*Tectona grandis* is a large deciduous tree with a rounded crown and, under favourable conditions, a tall clean cylindrical bole of more than 25 m. The base of the tree is often buttressed (having outgrowths at the base caused by exaggerated root swelling) and sometimes fluted (having irregular involutions and swellings in the bole). Leaves are broadly elliptical or obovate and usually 30 to 60 cm long. Over most of its range, teak occurs in moist and dry deciduous forests below 1000 m elevation and is one of the several species constituting mixed forest stands. It grows best in localities with annual rainfall of 1250 to 3750 mm, minimum temperature of 13°C to 17°C and maximum temperature of 39°C to 43°C.

Natural teak forests mainly grow on hilly and undulating terrain with traps, basalt, granite, schist, gneiss, limestone and sandstone as underlying rocks. The best teak forests, both natural and plantation forests grow in well drained deep alluvium. Teak plantations have failed completely when they have been established on low lying, poorly drained land with clay soils (Seth and Yadav 1959).
Teak is a light demanding species; it does not tolerate shade or suppression at any stage of its life and requires unimpeded overhead light for its proper development. Teak coppices and pollards vigorously and sometimes retain its coppicing potential even after attaining large size. Teak begins flowering and seeding at a young age, about 20 years from seedling and about ten years from coppice, and produces abundant seeds almost every year (Seth and Kaul, 1978). The hard thick pericarp of the seed prevents easy germination and a considerable portion of fresh seeds remains dormant in the first year. Teak seeds remain viable for many years.

Wood quality is the cumulative effect of wood properties on the end use of a timber species (Zobel, 1989). These wood properties impact either negatively or positively on the recovery, utilization and market price of timber and wood products. For example, in timber with a clearly demarcated sapwood and heartwood, those with a high percentage of heartwood will yield more saleable timber conversely, a high proportion of sapwood is not a problem in treated poles because sapwood is easily penetrated by preservatives and thereafter may be more resistant to pests and fungal infections than the heartwood itself, which may not be treatable or durable (Graham, 1973).

Teak timber produced in the natural forests of Myanmar, India and Thailand has exalted status in international markets, commanding prices as high as US$2000/m³ for logs (ITTO, 2002). This status is due, at least in part, to the inherent quality of the natural grown timber: it has a high proportion of heartwood, which tends to be dark and of a uniform golden brown colour, a medium texture, straight grain, streaky to uniform figure, and a small micro fibril angle which means that there is minimal shrinkage on drying. The woods density is medium (in the range 600-750 kg/m³), its strength moderately high and it is dimensionally stable. Teak timber peels, nails and screws well and takes good sanding and varnish. The heartwood contains an extractive sesquiterpene which renders it very resistant to fungal attack and immune to Lyctus, a wood boring beetle, and other insects (Chandrasekharan, 2003). Teak products therefore have a long service life, making the timber a long term prospect for carbon storage (Bhat, 2003, and Keogh, 2003).
The use of Teak in traditional medicine is well known, according to Ayurveda, wood is acrid, cooling, laxative, sedative to gravid uterus and useful in treatment of piles, leucoderma and dysentery. Flowers are acrid, bitter and dry and useful in bronchitis, biliousness, urinary discharges etc. Roots are useful in treatment of urinary system related troubles. According to Unani system of medicine, the oil of flower is hair promoter and useful in scabies. Wood is good for headache, biliousness, burning sensation and pain and liver related troubles. It allays thirst and possesses anthelmintic and expectorant properties.

Teaks high silica content of about 1.4 per cent may have a dulling effect on saws, and special carbide or tungsten tipped saws are usually recommended for milling (Chandrasekharan, 2003 and Kajar et al. 1999). Such relatively minor faults notwithstanding, natural forest teak remains one of the most sought after and highly valued timbers in the world, being used for flooring, interior and exterior furniture, joinery, musical instruments, poles and piles, structural applications, vehicle and ship building, sporting goods, veneer and plywood.

Tree planting practices prevail since ancient times. Planting of trees has been an integral part of the farm economy in most parts of India. Apart from their ecological significance trees provide mulch and shade for crops, fodder for cattle, fuelwood and timber for human beings. They also recycle nutrients complementing farm production. Farmers plant trees on homesteads and on farmlands to maximize overall return from their land. These practices illustrate that cultivation of trees on homesteads and farms achieves a number of profits for the farming community. Products like fuelwood, fruits and construction timber are consumed within household along with giving income to the family. Cultivation of trees is also linked with other agricultural activities and most of the time it does not involve exclusive use of land and labour (FAO, 1986).

Teak is known to perform well in plantations under favorable conditions. In this characteristic it contrasts with some of the more commercially known and valuable tropical hardwood species. For example, many of the species that make up the timber wealth of the African tropical forests have proved unamenable to growing in plantations for reasons such as exceedingly slow growth, susceptibility to mortality in establishment on cleared land (being climax rather than pioneer species) or
vulnerability to pests and diseases. Mahogany (*Swietenia macrophylla*) is one of the few other luxury hardwoods that is extensively grown in plantations. It seems likely that there will be a significant divergence in future timber supply potential between those species amenable to plantation and those largely dependent on an established natural forest habitat.

Mixed plantations of teak with other tree species are generally less susceptible than pure teak plantations to soil erosion and pest and disease risks. Pure teak plantations are susceptible to defoliating pests, particularly when understorey growth is suppressed and site conditions are suboptimal. Teak, relative to other species is easily established in plantations and because of the enduring global demand for products from teak; it has good prospects as a plantation species. These prospects are boosted by the rapidly developing trend of replacing lumber with reconstituted panels (Loke 1996). Sliced veneer of teak as a lay on for reconstituted panels is assured of a demand for its value in enhancing the potential for panels to substitute for lumber in a widening variety of applications.

Apart from the introduction of teak in Java, Indonesia, the first teak plantation was started in 1680 in Sri Lanka. Teak planting in India began in the 1840s and increased to significant levels from 1865 onwards. Teak plantations using the “taungya” method, in which a forest crop is established in temporary association with agricultural crops, were initiated in Myanmar in 1856 and in Indonesia around 1880 (Pandey and Brown, 2000).

Teak was first introduced outside Asia in Nigeria in 1902 (Horne, 1966), with seed first from India and subsequently from Myanmar. Planting in eastern Ghana (formerly Togoland) started around 1905 (Kadambi, 1972). A small plantation of teak was established in Cote d’Ivoire in 1929 from plantation grown seeds obtained from Togoland. The first teak plantation in tropical America was established in Trinidad and Tobago in 1913 (Keogh, 1979) with seed from Myanmar. Planting of teak in Honduras, Panama and Costa Rica stared between 1927 and 1929.

Statistics on the historical progress of teak plantation establishment are incomplete, but it is clear that up to 1950 the major area under teak plantation was in Java, Indonesia, with about 300,000 ha. There was a gradual increase in the area of teak
plantations through the 1950s and 1960s to an estimated 900,000 ha in 1970 (Kadambi 1972 and Tewari 1992a). The pace of teak planting further accelerated in the late 1970s, mainly as a result of financial support provided by external donor agencies. The total area of teak plantation increased to 1.7 million ha in 1990 (FAO, 1995). More than 90 per cent of the 1990 total was located in Asia.

Teak plantations constitute about 8 per cent of the total plantation area in countries with climates suitable for teak growing. In 1995, about 94 per cent of global teak plantations were in tropical Asia, with India (44 per cent) and Indonesia (31 per cent) accounting for the bulk of the resource. Other countries of the region with significant planted teak resources were Thailand (7 per cent), Myanmar (6 per cent), Bangladesh (3.2 per cent) and Sri Lanka (1.7 per cent). About 4.5 per cent of global teak plantations were in tropical Africa (largely in moist West Africa, particularly in Cote d’Ivoire and Nigeria) and the remainders were in tropical America (mostly in Costa Rica and Trinidad and Tobago) and the Pacific Islands.

The need for forest plantation was realized as early as the mid nineteenth century. The first attempt at organized plantation in India was a teak plantation established in 1842 at Nilambur in Kerala, Southern India with the purpose of enriching the forests (Bapat and Phulari, 1995). Chatu Menon, well known as the father of Indian teak plantations, raised more than a million teak plants between 1842 and 1862 (Parameswarappa 1995). In Central India, the first teak plantation was raised in 1891, by Mr. Maniram, a forest guard, in about eight hectares near Girdpuri, Raipur district of Madhya Pradesh (Tewari, 1992a). Majority of the teak plantation are mainly raised in the state of Andhra Pradesh, Assam, Bihar, Goa, Gujrat, Kerala, Karnataka, Madhya Pradesh, Maharashtra, Orissa, Tripura, Tamil Nadu, Uttar Pradesh, West Bengal and Andaman and Nicobar Islands (Tewari, 1992a). Now, approximately 50,000 hectares of teak plantation are raised annually in degraded forest lands under plan scheme and also under externally aided projects.

Commercial teak plantations were raised for the first time by Maharashtra Development Board in 1968. Forest Development Corporation raised commercial plantation in a large scale. At present Forest Development Corporation of Maharashtra has raised about 0.165 million hectare of teak plantation for 1968-1998. Establishment of plantations in other parts of the country followed. Tree planting
activities were expanded with the introduction of the taungya system for teak plantation, first evolved in Myanmar in the 1850s as a mode of replanting teak trees (Negi, 1986). Organized plantations on a large scale were attempted only after 1948, and until 1951 plantation was not a regular and extensive activity (Tewari, 1992b).

After Indian’s independence in 1947, planned tree plantation schemes began with the commencement of the first five year plan (1951 to 1956). At first, planting was undertaken mainly in government owned forests, and little importance was given to plantations on private land. Laws against cutting and marketing of trees from both public and private lands, introduced to mitigate an alarming loss of tree cover, had the opposite effect: farmers, fearing that they would not be able to sell trees, began to plant fewer trees (Kerr, 1997).

In 1976, the report of the National Commission on Agriculture called for investment in social forestry, including farm forestry, to meet the fuelwood and small timber needs of rural people (GOI, 1976). During the sixth five year plan (1980 to 1985), tree plantation programme gained considerable momentum. Expenditure on tree plantations increased dramatically, from 1073 million rupees (Rs.) (US$153 million) during the fifth plan (1974 to 1979) to Rs. 9260 million (US$780 million) during the sixth plan (1980 to 1985) (ICFRE, 1999). Most of the farm forestry programme on private lands provided subsidies to farmers (Balooni, 1991).

More recently, with increased concern for environmentally sustainable development, investment in tree planting in India has been given more importance, as witnessed by the National Forest Policy of 1988 which envisages an increase in forest cover (currently about 19.5 per cent) to at least one third of the total geographical area of the country. During the period 1990 to 1996, tree plantations were established on almost 6 million ha of public lands, including forest lands, and more than 7000 million seedlings were distributed for planting on private lands (ICFRE, 1999).

Tree planting programme require large amounts of capital. Foreign funds for tree plantations have increased substantially in recent years through international donor agencies. However, there is no assurance that the Government of India’s investments in tree plantations or the forestry sector as a whole will increase in the future, as the demand for investment is also being made by other sectors of the Indian economy in
the present era of economic liberalization. Therefore, apart from government agencies, the private sector will also have to play a significant part in increasing investments in these programmes in the coming years. Such investment will help to resolve the shortage of raw material for processing industries and will also increase the country’s forest cover.

Government influences on plantation establishment generally fall in two categories: direct government planting programme and the payment of incentives for plantation establishment. The great majority of the world’s teak plantations have been established under government planting programme. The government has had a dominant role in plantation establishment in India, Indonesia, Myanmar and Thailand, countries that account for about 87 per cent of the world’s teak plantations. Several countries in Central America and Africa also have utilized incentive policies to promote teak planting. Policies in Central America, particularly in Costa Rica and Panama, are currently attracting much attention.

Among housing and furniture grade timbers in India, teak wood constitutes the premium class. India has over 9.77 million ha under natural teak forest (Bapat and Phulari, 1995), but severe restrictions on the harvesting of teak from natural forests, introduced in 1997, have limited the domestic supply. Even though India is one of the biggest producers of teak in the world, a large amount of timber is imported to meet the internal demand of the plywood and veneer industry (Bebarta, 1999). Teak plantations have become important to help fill the gap between demand and supply of teak wood. The country has more than 500 000 ha of teak plantations, and there is a large ongoing programme to plant almost 50 000 ha annually (Khullar, 1995).

In developing country like India, forests play an important role in the environmental and socio-economic sustainability, as forests are rich source of energy, timber and fodder along with employment to a large section of rural population. In India, the demand for forest products and services is increasing with rapid economic growth, industrialization and increasing population.

India occupies 2.5 per cent of world geographic area, including 76.5 million ha. (23% of total land mass) under forest cover. Unfortunately the productivity of forest is very low as 0.7 m³ as against the world average of 2.1 m³/ha per annum.
As per the FAO, (2005) the production, consumption along with import of timber products in India is summarized as follows

Table: Production, consumption and import of timber products ('000 cu.m.) in 2005

<table>
<thead>
<tr>
<th>Item /year</th>
<th>Production</th>
<th>Consumption</th>
<th>Import</th>
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<tbody>
<tr>
<td>Round wood/logs</td>
<td>13500</td>
<td>16535</td>
<td>3036</td>
</tr>
<tr>
<td>Sawn wood</td>
<td>6000</td>
<td>5984</td>
<td>11</td>
</tr>
<tr>
<td>Veneer</td>
<td>258</td>
<td>259</td>
<td>6</td>
</tr>
<tr>
<td>Plywood</td>
<td>1936</td>
<td>1911</td>
<td>9</td>
</tr>
</tbody>
</table>

The round wood production registred a compound growth rate of 2.03 percent for the time period of 1970 - 2000, whereas the fuel wood and charcoal witnessed increased at the rate of 1.98 percent per annum. The industrial use of wood and production of sawnwood recorded increased in growth rate at 2.84 and 6.54 percent respectively.

India, among the tropical countries has a total forest cover of over 67 million hectares which represents about 20 per cent of the land area of the country. As per the National forest policy; 33 per cent of the land area shall be covered under forest. India accounts for 2.47 per cent of worlds’ geographical area, but has only 1 per cent of world’s forests (Bhat, 2006).

A huge human population, of more than a billion coupled with more than 500 million of livestock, exerts immense pressure on its natural resources, including the forests. Improved standards of living have increased the demand for timber and timber products. The natural forests cannot meet the increasing demand for timber and is being fulfilled partly by timber obtained from the Tree outside Forests (TOF) and imported timber. Around 95 per cent of the Indian forest is classified as tropical, with relatively low productivity, partly due to degradation over large areas. With an estimated growing stock of 2.7 billion m3, the predominant product is fuel wood, in which the country is maintaining self-sufficiency. The forest-derived fuel wood is augmented by supplies from trees outside the forest (TOF), which cover nearly 2 per cent of the land area and are playing an increasing role in the provision of fast grown raw material for the panel, pulp and paper industries (Bansal, 2006).
India holds enormous scope for teak plantation in private sector. The country on account of its tropical position has congenial climate and edaphic factors suitable for teak plantation. Apart from this teak excels other timber species in productivity and ecological adaptations.

In market economy, situation has come where, because of increasing demand, the prices of teak and other timber species are increasing by leaps and bounds. Prices of teak wood have registered an increase of 200 times in the last 35 years. Besides this, teak is emerging globally as the major timber species for industrial and domestic use. In coming years the projected increase in the use of industrial wood is 13 fold (Bebarta, 1999).

The high prices paid for teak, which can be attributed to the limited availability of natural teak in the international market, have prompted the establishment of a large and growing teak plantation estate across the tropics. Unfortunately, this has resulted in sacrifices in wood quality. Compared to its natural forest counterpart, plantation teak grown on rotation of 21-30 years often has a high proportion of sapwood and juvenile wood, while wood figure including colour, grain and texture are supposedly inferior. Plantation teakwood has lower density and strength than natural teak, a larger micro fibril angle (leading to greater shrinkage) and less durable heartwood. Some studies suggest that these differences may not always be great Bailleres and Duran (2000), for example, reported that 21 years old plantation teakwood can have similar strength to mature aged teakwood from natural forest. Nevertheless, the cumulative effect of differences in various wood properties, coupled with the much smaller dimensions on offer in plantations, is that plantation teakwood is no match for mature aged natural teak in the marketplace.

Forestry in India as a private venture is in its infancy, although scientific forest management is approximately 100 years old. Forest - as a resource of environmental and economic importance - has moved from a status of diffused (ownership wise), unmanaged and unlimited resource, to the status of a fully owned (government ownership), unitarily managed (Forest Department) and very scare resource. The present day upsurge in environmental awareness, and the role of forests in environmental conservation, has enhanced the importance of this sector to such an
extent that people from various walks of life are suggesting innovative ideas of management for the resource.

Teak plantation is a productive economic activity that produces benefits in the form of goods (timber, poles, etc.) and services (amelioration of microclimate, watershed, reduction of soil erosion, provision for shelter and shade, etc.). In teak plantation, the economic crops being produced are homogeneous, species are selected to suit the object of management; growth is rapid and there is a relatively rapid turnover with quick and high returns on investments per hectare. However, teak plantation involves costs in the form of materials consumed and the time of productive factors like land, labour, capital diverted from other useful employment. According to Worrel (1970), a comparison of these benefits and costs give information for policy decisions on alternative use of land.

Teak planting, which was once mainly the domain of government forest departments, is today also attracting the interest of the private sector. In tandem with the involvement of farmers in planting teak, a shift from large to small scale plantations and from long to shorter rotations can be observed. Advances in tree breeding and mass multiplication techniques enable the production of healthy and uniform planting material on a large scale. Many private companies have taken advantage of the latest technical developments, incentives offered by a number of governments and the growing interest in teak by publicizing potentially attractive returns on investment in teak. However, in several countries policies and legislation restricting harvest and transport of teak, designed to protect natural forests but applying even to teak grown in plantations, act as disincentives to private sector investment.

Many teak plantations do not make use of current knowledge; growers are ignorant of lack access to relevant information and therefore do not adopt research results and/or apply known technologies effectively. Small scale growers and farmers are particularly disadvantaged in this respect. Information on the spread of technologies and their effect on productivity is lacking. Most public sector teak plantations are managed under low intensity/low investment regimes and with a reliance on low cost technologies. Differences in management objectives, the level of investment and environmental conditions explain the variability in production systems and technologies adopted. Teak can be produced under diverse conditions, but high
productivity can only be expected on good and accessible sites for which competition from a number of cash crops such as oil palm, fruit trees and vegetables is intense. In many countries teak is being planted on degraded land, which explains, at least in part, the poor performance.

There has been considerable controversy over the quality of plantation teak and the effects of shortening the growth cycle. The main qualities of teak are durability and aesthetic appeal. Various studies have come to different conclusions as to whether there are physical differences between plantation grown timber and timber harvested from natural forests. The Results reported by Bhatt (2000) explain that shortening the growth cycle had no effect on the physical properties of teak. Durgand (1984) reported negative effect on timber quality. In terms of aesthetic properties, timber that grows quickly and is felled when young does not have the desired qualities, it is duller, paler and more uniform, less oily looking and less pleasant to the touch. The major problem is that short cycles do not allow for heartwood formation, which is a slow process, in young trees, the proportion of sapwood can be as high as 50 per cent (Societe Forestiere Tropicale, 1994).

Investment in tree plantations, which was always relatively low in India, has recently grown in importance. Forest based industries, recognizing that the existing forests cannot continue to meet their raw material requirements, are expected to play a significant part in increasing investments in plantation programmes in the coming years. Private investment in teak plantations has arisen as a response to the growing demand for housing and furniture grade timbers, of which teak is the most valued. India is one of the largest producers of teak in the world, but the supply does not meet national demand.

Since 1991, plantation companies in India have been promoting schemes offering investors teak trees at a nominal cost with an expectations of spectacular returns after as little as 20 years. Such tree plantations could certainly contribute to the supply of timber and other tree products and could help to increase tree cover in the country. However, some unscrupulous companies, inadequately regulated, have exploited investors by promising impossible returns, closing their companies or failing to plant trees at all. Many of the claims made by promoters of teak investment programmers are inconsistent with the silvicultural and economic research on teak.
These unethical practices and inflated claims put into question the future of teak investment programmes in India.

The key point is that long term forestry investments with uncertain returns lend themselves to overly optimistic investment projections, which are initially highly attractive but are likely to lead to investor disillusionment and bring the sector into disrepute in the longer term.

The challenge for teak growers is to raise the quality of plantation grown teakwood under fast growth regimes. Extending the rotation length would yield better quality, but most investors demand a faster return on their money. Genetic selection and manipulation through tissue culture techniques and prudent silvicultural practices will help to accept the challenge. Mandal and Chawhaan (2003) advised that efforts should be made to increase specific gravity, since any small grain will have a positive impact on wood quality; they found a low but positive correlation between specific gravity and height, heartwood and diameter at breast height. Specific gravity is an inherited trait and is therefore amenable to genetic improvement (Zobel and Talbert, 1984). Silvicultural treatments like thinning and pruning, if carried out judiciously, should also improve wood quality, producing timber with fewer knots and bends, less taper and more heartwood.

Increase in yield and higher uniformity from shorter rotations are key incentives for developing intensively managed teak plantations. However, no adequate data are available for teak timber production under intensive silvicultural practices in most teak producing countries (Bhat, 1998). In the tropics, most of the tree plantations grown for saw timber require early, heavy and repeated thinning in order to sustain rapid diameter growth of the selected trees (Galloway et al., 2001). However, it is not clear if such rapid diameter growth may be detrimental to certain wood properties.

Evidence of wood mechanical properties between 21 and 65 year old teak trees offer scope for reducing the rotation age of this fast growing species without affecting timber strength. Yet, the available data on the effects of spacing and thinning regimes on wood quality are insufficient for designing an efficient management system (Bhatt, 2000). Although Teak is an established high value timber tree for commercial planting,
the quality and yield of the timber from young aged plantations often fail to meet expectations (Tze, 1999).

Economic analysis of the actual performance of teak plantations in different plants of India has not been carried out as productivity figures are not available. The productivity obtained in Nilambur teak plantations which has a continuous history of over 150 years of teak raising ranges from an MAI of 0.973 to 5.641 m$^3$ ha$^{-1}$ in the lowest and highest respectively. The cost of establishment and maintenance of teak plantation in Nilambur division of Kerala State in US$ 2474 ha$^{-1}$ with and returns of US$ 56,293 with not returns of US$ 53919. (Subramanian et al., 1988).

Tree farmers grow trees for many reasons: for forest restoration, for conservation of native species, for recreation, and as a business. If a farmer is growing timber as an investment, he needs to analyze the profitability of his business. Economic decisions tree farmers face includes which tree species to grow, when to harvest and when to replant. He may also wish to compare the financial benefits he would obtain from his forestry activity with those he would obtain from other land use alternatives. A key difference between the economic forestry and most agricultural land uses is that the financial returns to forestry are often delayed for years. Therefore, time value of money has to be taken into account when planning investments in forestry.

A consideration of benefits and costs leads to basic economic criterion of whether the teak project should be accepted or rejected in respect of financial and social grain of resources utilization from the stand point of the society. An activity should not be undertaken unless its total benefits (revenue, employment, stability, etc.) exceed its total costs.

Tree growing on farmer’s field helps in enhancing the productivity of land. Its aim is to achieve more sustainable and diversified output from the land than what is possible in conventional cropping system. Tree growing appears to be the best remedy not only to maintain but to enhance the income of the farmers.

In Vidarbha region of Maharashtra state, many farmers have planted teak on their farms. It is therefore, necessary to have information on economics of teak with the constraint in growing on farmers land. In view of the above the present study was
undertaken with the following objectives.

1. To study the economic status of selected teak growers.
2. To study the economics of teak plantation.
3. To examine financial viability of teak plantation.
4. To study the resource use efficiency in teak plantation.