Introduction
Forests were viewed as not only the source of biomass-based material like food, fodder, timber, medicines etc. but also cultural, spiritual and religious values associated with them. Appointment of Dietrich Brandis as the first Inspector General of Forests in India heralded a new era of scientific forest management (Kotwal et al., 2003) in the country. This scientific management regime based on the principles of sustained yield focused primarily on timber production which was the priority at that time. The protective and socio-cultural functions of forests often received less attention, if any during the colonial times (Anon, 1998). Plantation forestry is recognised as a raw material base for industrial and domestic wood products, which provides perpetually renewable energy, fiber and timber. The economic benefits of planted forests have led to their widespread adoption throughout the world. Globally 48% of the forest plantation is established for industrial use, 26% for non-industrial use (fuel wood, soil medicine and water conservation) and the remaining 26% is not specified (Yashodha et al., 2004).

The increasing world population required more food, fuel and space for habitation. Hence indiscriminate deforestation by man for his own interest i.e., for agriculture, construction and habitation purpose ultimately reduces the forest covered area on earth. It is feared that in the coming decades, there is going to be an acute shortage of forest products and the ecological balance will be lost. Many forest trees are propagated negatively by cutting, grafting, layering etc.

Majority of the population still depends on forest resources for their food, clothing, housing, medicine, agriculture, fodder and fuel wood. The loss of biodiversity is a direct and irreversible attack on their livelihood and social security witnessing a woeful sight. Forest is an important renewable natural resource for man. Forest has also other uses such as recreation, wild life, habitat, air and watersheds. From ecological view point forest regulates the level of rainfall necessary for the existence of vegetation in earth. It also helps in recycling the moisture. Forests checks flood, drought and soil erosion. The earth's biological diversity is more threatened today than in any other time in the past. During the last 2000 years 100 to 1000 species
became extinct in each country. But today we are losing about 1500 species for every two months.

Plantation forestry either of introduced or indigenous species, involves the use of genetically improved planting materials derived from tree genetic improvement programmes. Traditional breeding approaches are a long term process to produce propagules of high quality; however they are considered prerequisite for the effective utilization of biotechnological techniques such as micropropagation and genetic engineering. The major challenge for the tree breeder is to quickly transfer the ever improving material from the breeding programmes into plantations. The basic method of achieving such transfers is the use of seeds from orchards or clonal propagation. In view of the fact that open pollinated orchards are not an option for capturing high genetic gains, clonal propagation of selected genotypes through micropropagation is commonly used for acquiring genetic gain in a short time. Advantages of cloning in plantation establishment have been well discussed (Zobel, 1993; Ahuja et al., 1993).

Micropropagation systems, such as axillary and adventitious shoot multiplication and somatic embryogenesis, employed in plantation forestry is regarded as an imperative strategy to achieve rapid genetic gain (Ritchie, 1996; Libby and Ahuja, 1993; Hains and Martin, 1997). These techniques are currently in use for the large scale multiplication of important tree species (Sita and Swamy, 1998). Further, micropropagation is the only choice for the multiplication of difficult to root but economically or industrially important genotypes. Micropropagation has been applied to many tree species for rejuvenation and mass multiplication (Merkle and Trigiano, 1992; Bonga and Von Aderkas, 1992). The potential impact of cloning through micropropagation methods on planted forests (Yanchuk, 2001), forest industry and global timber supplies is now well recognised. The role of tissue culture for the production of quality proposals in tree species has recently been also emphasised (Jain and Ishii, 2003).
The beneficial impact of using biotechnology in forestry would be greater than for most agronomic or horticultural species. The long breeding cycles and prolonged progeny analyses have greatly limited the potential of conventional breeding programmes for producing improved planting stocks. However, research on micropropagation, over a reasonable period, has enhanced the realization of the benefits of tree improvement. Improved ability to propagate vegetatively the selected material, to regulate flowering and breeding, and to regulate growth rates and wood quality would be of great benefit to tree improvement programmes. The most promising research areas in this context could be those concerned with rejuvenation, somatic embryogenesis and genetic transformation. These research areas are strategic in underlying future applications, and should be pursued with model species such as Eucalyptus. In recent years, liquid culture systems based on somatic embryogenesis has a most potential to produce plants in millions, and now has become a routine practice in few gymnosperms. However its use in hard wood plants is not yet to be realized because of several limitations, such as low number of somatic embryo germination, genotype influence and limited number of explants, inducing somatic embryogenesis. Further, the availability of embryogenic system is now considered as an important prerequisite for genetic transformation studies (Yashodha et al., 2004).

In India, the tissue culture of trees has become commercially important and also feasible. Even, if the production cost of the tissue cultured plants are slightly higher than that of seeds, the expected increase in production makes the operation a profitable venture. Further, the technology delivery with effective dissemination channels has to play a major role in the commercial production of micropropagated plants in India. In this context, the technology adoption constraints need to be identified and addressed to introduce tissue cultured plants in plantation or farm forestry. Further more, technology has always to be understood in a dynamic way. For instance, adoption of tissue culture technology will have to facilitate the use of genetically engineered plants as soon as they become available in near future. About 75 commercial tissue culture units, situated all over India are operating in collaboration with overseas companies, with buy-back arrangements, having varying capacity of
1 million to 25 million. The spare capacity of these units may be used effectively for micropropagating tree species and for enhancing improved planting stocks to meet the immediate requirements (Yashodha et al., 2004).

Most tropical leguminous trees apart from fixing atmospheric nitrogen through nodule development also fix the nitrogen from V.A.M association; Mycorrhizae also increase nodulation in various legumes resulting in higher fixation of atmospheric nitrogen in roots (Harley and Smith, 1983). VAM fungi had significant effects on nodulation and nitrogen fixation (Kaushik et al., 2003).

Legumes can fix atmospheric nitrogen in the root nodules in a symbiotic relationship with rhizobium bacteria. These bacteria enrich both plants and soils with nitrogen and it is estimated that 175.107 tonnes of nitrogen have been annually gained in the world in this way (Gurbuzer, 1980). Legume cultivation in the world is increasing, so is the biological fixation of nitrogen into the soil. Therefore soil becomes more fertile and crop production increases. Due to the reasons mentioned above, nitrogen will be fixed to the soil and most of the needed nitrogen of chickpea will be obtained by using Rhizobium strains well adopted to natural conditions.

In our country nearly 20,000 plant species are used for medicinal purposes (Khamboj, 2000). Mass propagation of several medicinal plants with desired qualities increased in the last few years (Rajendra and D’Souza, 1999; Patnaik and Debata, 1996) for sustainable utilization. All over the world in recent years, there is an upsurge and interest in the use of medicinal plants, crude extracts and active ingredients to treat various ailments. This is due to the need to discover new molecular structures as lead compounds from plant kingdom. In fact several medicinal plants are listed in standard Ayurved monographs. One such plant is Cassia siamea Lam. The root and bark of Cassia siamea Lam., a tree endemic to Central and East Africa, have been used in folklore medicine to treat stomach complaints and as a mild purgative. The anthraquinones occurring in the plant were found to be antitumour active. Cassiamin B, present in the plant is an antitumour
promoting and chemo-preventing agent. Sastry et al. (2003) carried out chemical investigations of stem bark of *Cassia siamea*.

In view of its importance in medicine and forestry we have undertaken *in vitro* propagation studies of *Cassia siamea* Lam.

**Morphology of Cassia siamea** Lam.

Evergreen tree, up to 12m tall; bark grey, rough, longitudinally fissured; wood dark brown; branchlets glabrescent, lenticellate. Leaves paripinnate, 10-15cm long, petiole to 3cm; leaflets 7-15 pairs, chartaceous, elliptic oblong, 2.3-5.5 x 1.1-2.2cm, glabrous above, pilose below, apex obtuse, tipped with small sharp mucro, margin entire, base obtuse, petiole to 4mm. Flowers pale yellow in 20-30cm long, axillary and terminal corymbose panicles. Pod oblong, flat, 15-25 x 0.8-1.5cm long, brown when ripe, minutely velvety, thickened at sutures; seeds 20-30, dark greenish (Pullaiah and Sandhya Rani, 1999) (Plate – 1A,B).

Planted as an avenue tree and then naturalised. Recommended for covering the denuded areas, hill slopes, flat terrain provided the drainage is good.

**Flowers:** Sept.-Dec., but the flowering period is comparatively long.

**Fruits:** Mar.-Apr.

**Vern.:** Seema tangedu, Niala tangedu.

**India:** Cultivated and naturalised throughout.

**World:** Sri Lanka, Myanmar, Malaysia, Thailand, Indonesia, Taiwan, Philippines, widely cultivated in tropics.

**Objectives of the study**

The present investigation was undertaken with following objectives:

- To standardize the protocol for *in vitro* seed germination.
- To standardize the best suitable media, and explant for developing protocols for an efficient shoot regeneration.
PLATE – 1

A. Natural habitat of Cassia siamea
B. Plant in flowering
• To evaluate the best suitable phytohormones and growth additives for high per cent frequency of multiple shoots.
• To standardize suitable auxins for callus induction.
• To standardize a perfect protocol for in vitro rooting and subsequent protocol for acclimatization of in vitro raised plantlets with high per cent survivability rate.

The entire research work has been compiled and presented in five chapters. Chapter-1 consists of General introduction, Chapter-II Review of Literature, Chapter-III Materials and Methods, Chapter-IV has Results and Discussion and Chapter-V consists of Conclusions. At the end bibliography shows updated references presented in an alphabetical order.