INTRODUCTION

Agroforestry first developed in Thailand in 1911 to prevent the practice of shifting cultivation. Only recently, the utility of this system got recognised, everywhere, for redeeming the ills of land use management. The subject has been well taken at the level of both conceptualization and materialisation. Opinions have been expressed for accepting agroforestry as a new approach which aims to reconcile agricultural and forestry sciences (Malik, 1973; Mishra, 1979; Sangal, 1981; Goswami, 1982; Rocheleau et al., 1986; Michon & Bompard, 1987; and Betters, 1988). It represents a holistic approach to land use in which woody perennials, crops and sometimes animals shared the same land management unit. To give impetus to agroforestry, the FAO has founded an International Council for Research in Agroforestry (ICRAF)
in 1978. A research institute has also been established at Nairobi with the main objective of accelerating programmes on agroforestry in the developing countries. The FAO continues to be the leader in the activities and aspects of agroforestry like agri-silviculture, and agriforestry - the old name for Taungya cultivation.

The agri-silviculture has been defined by King (1979) as an agroforestry practice involving a conscious and deliberate use of land for the concurrent production of agricultural crops and forest tree crops. Mixed arable crops and tree systems have the potential to offer more to the cultivator than either arable crops or tree crops alone. The essential beneficial elements in agri-silviculture are (1) greater overall biomass productivity, (2) a better balance of desired products, (3) reduction of risk of total crop failure, with presence of a perennial tree crop, and (4) a longer span and better distribution of products over time, both in annual cycle and in the long term (Hocking, 1984).

While recommending agri-silviculture as a better agricultural land use practice to small farmers some scientific enquiries must be made of the farmers' production objectives. The question that first occurs to small cultivators in response to suggestion that they should take up tree planting on their crop fields is - what will be the effect of trees on the yield of arable crops. The effect may be negative or positive depending upon the chosen components of the system and their management. Hocking (1984) has stated that in agri-silviculture an over all productivity increase is possible only at the cost of lower
productivity of the previous sole crop. The yield loss of that crop being more than made up by the production of other yield components of the additional tree crop. The interesting question, scientifically, is how the additional productivity is achieved.

If more net biomass can be produced by agri-silviculture, it will benefit big as well as small land owners. The total package, however, may have more internal value to the small farmer than the large. Therefore, self-sufficiency in food, off-season fodder, fuel wood, etc. will be of more value to him.

Conversion of forest land now needs a combination of agriculture and forestry to augment production and check destruction of forests. With functional allocation of 47.5% land area under agriculture and 22.5% under forestry in India, the country is not able to meet the requirements of its growing human and cattle population for food, fuel, fodder, etc. In a tropical country like ours, the presence of an adequate forest cover is all the more necessary for agriculture. Trees help agricultural crops by conservation of soil and moisture, protecting them from hot wind and climatic extremes, increasing water-table and sub-surface flow, and in minimizing run-off and flood havoc (Pradhan and Dayal, 1981). Continuously depleting forest cover accompanied by rapid population growth and inefficient energy use patterns will result in a tragic short fall of fuel wood in India by the year 2000 A.D.

Bhaskar & Rao (1987) have optimistically forecast that, if all farmers in India use farm forestry techniques, there will be a great potential for firewood and small timber in the country in the 21st century. A mixture of trees which supply green manure, fodder, firewood and timber
could be grown successfully on field bunds and other places. There is a need to develop viable agri-silviculture systems especially for small farmers which are likely to increase in number in near future.

Bentley et al. (1984) have rightly stated that agroforestry (agri-silviculture) is not a panacea for rural poverty, nor will it make low productivity agroclimatic regions of India as rich as the Punjab and Haryana. It is a set of land use alternatives that, if developed with resource-poor farmers in mind, can provide increased values and reduced risks.

Agri-silviculture is paying and will attract farmers if short rotation crops of 8-10 years are introduced. This will convert marginal agricultural land to good tree cover, accruing economic benefits to farmers and helping them in meeting fuel, small timber, and fodder requirements. Design of agroforestry systems requires a land management planning process that clearly specifies wants, needs, and objectives along with the suitability of land for potential agroforestry practices. Within this planning process economic analysis can be done to determine socio-economic fitness of the agroforestry or agri-silviculture alternatives. Certain economic performance measures such as, present net value and benefit-cost ratio can be used to determine the best 'joint production' level for a particular agri-silviculture practice.

So far, the agroforestry considerations mostly are theoretical propositions or a few subjective evaluations of certain traditional practices of agriculture and forestry. Nevertheless, the importance of agroforestry as the most
viable land use management systems, in times of increasing energy crisis, gets established beyond doubt.

In Chhattisgarh, the 'rice-bowl' of India, cultivation of rice is done in small-sized fields having high bunds for water retention. In most of the rice fields, which are situated on black kanhar or yellow matasi type of soil, babool (Acacia nilotica L.) trees grow naturally. As a useful practice the farmers allow some babool trees to grow on field bunds and also in midfield randomly (Plate 0). Though, this is only a traditional practice of the farmer, it appeared a beneficial and viable system of agri-silviculture representing joint production of food, fuelwood, fodder and small timber for the farmer.

The present study was designed, as an outcome of our observations, to scientifically evaluate productivities of rice and babool tree crops, and also to assess the socio-economic aspects involved in this agri-silvicultural practice. By objectively selecting fields with varying babool plant densities on bunds and/or midfield, observations have been taken on quantitative effects of the tree canopy cover on yield of rice crop and tree productivity values over a specified period of time. The main objective of this thesis is to provide a package of practice for the farmers using rice and babool as a compatible agri-silviculture system in this agroclimatic region of our country.