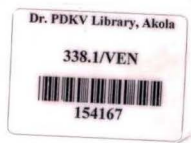


**PRODUCTION AND MARKETING OF TEAK IN
AKOLA DISTRICT**

THESIS



**Submitted to
Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola
in partial fulfilment of the requirements
for the Degree of**

**MASTER OF SCIENCE
IN
AGRICULTURE
(AGRICULTURAL ECONOMICS)**

**By
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DECLARATION OF STUDENT

I hereby declare that the experimental work and its Interpretation of the thesis entitled "**PRODUCTION AND MARKETING OF TEAK IN AKOLA DISTRICT**" or part thereof has neither been submitted for any other degree or diploma at any university, nor the data have been derived from any thesis / publication of any university or scientific organization. The source of materials used and all assistance received during the course of investigation have been duly acknowledged.

Place: Akola

Date: 31/05/2011



(Venkatesh S) S/o S Reddy

Enrolment No. DD/1341

CERTIFICATE

This is to certify that the thesis entitled "**PRODUCTION AND MARKETING OF TEAK IN AKOLA DISTRICT**" submitted in partial fulfillment of the requirements for the degree of "**Master of Science in Agriculture (AGRICULTURAL ECONOMICS)**" of Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola is a record of bonafied research work carried out by Venkatesh S under my guidance and supervision.

The subject of the thesis has been approved by the student's Advisory Committee.

Place: Akola


Dr. (S. C. Nagpure)

Chairman,
Advisory Committee

Date: 31/05/2011

Countersigned

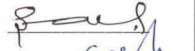


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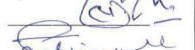
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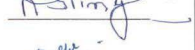
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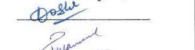
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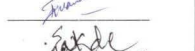
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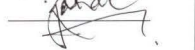
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Place: Akola

Date: 31/05/2011


(Venkatesh S) S/O S. Reddy

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LIST OF ABBREVIATIONS

%	:	Per cent
/	:	Per
<i>et al.</i>	:	et alia (and other)
@	:	At the rate of
i.e.	:	Id est (that is)
No./no.	:	Number
p.p.	:	Page number
qtls	:	Quintal
viz.,	:	Videlicet (namely)
etc.	:	et cetera
Rs.	:	Rupees
Ha.	:	Hectare
Pg.	:	Page
Avg.	:	Average
°C	:	Degree centigrade
mm	:	Millimeter
m ³	:	Cubic meter
IRR	:	Internal rate of return
NPV	:	Net present value
PBP	:	Payback period
PI	:	Profitability index
BCR	:	Benefit cost ratio
Sq	:	Site quality classes
Cm	:	Centimeter
Ft ³	:	Cubic feet
MAI	:	Mean annual volume Increment
US \$:	Currency of United states
p ^H	:	Negative charge of hydrogen ion
₹	:	Rupees

F) THESIS ABSTRACT

- a) Title of the thesis : PRODUCTION AND MARKETING
OF TEAK IN AKOLA DISTRICT
- b) Full name of student : Venkatesh S. s/o Sudharshan Reddy
- c) Name and address of Major
Advisor : Dr. S. C. Nagpure
Assistant professor &
Technical Officer to Dean (Agri.)
- d) Degree to be awarded : M. Sc(Agri.)
- e) Year of award of degree : 2011
- f) Major subject : Agricultural Economics
- g) Total number of pages in
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- i) Signature of student : 
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ABSTRACT

Teak is one of the most important and valuable indigenous timber trees of India. The need for forest plantation was realized as early as the mid-nineteenth century.

Total 60 teak growers was selected for teak plantation, 15 wholesalers and 15 retailers were selected for marketing of teak. Simple tabular analysis was used such as averages and percentages etc.

Two types of costs are involved in growing teak trees are establishment cost and recurring maintenance cost.

The per hectare total cost of establishment of teak plantation was worked out to be ₹ 76335.45 for an initial period of 5 years. Per hectare cost of maintenance was worked out which were ₹ 2, 34, 348.08/- and per hectare total cost of teak cultivation was ₹ 3,10,683.53/-

The gross returns per hectare of teak plantation was ₹ 15,62, 301/-. The average net returns per hectare was ₹12, 51,617/-. The per hectare per year cost was ₹ 15, 534/- and the average returns per hectare per year of teak plantation was worked out to ₹ 78, 115/-.

In order to examine the economic feasibility of teak growers net present value (NPV), Benefit cost ratio (B-C ratio), Profitability index (PI), Payback period (PBP) and Internal rate of return (IRR) were worked out.

The BCR, NPV and PI at 12% discount rate was 1.69, ₹ 92, 232/- and 3.60 per cent respectively. While corresponding figures at 15% discount rates were worked out to be 1.30, 34,609 and 1.39 and Payback period (Years) and Internal rate of return (per unit) was 9 and 18.39 respectively.

The resource use efficiency of teak plantation were, the total human labour (man days) were found positive and significant at 10 % level. Similarly, manures and irrigation were positive and significant at 1 per cent level. The coefficient of multiple determination: (R^2) was 0.481. The only one marketing channel was found i.e. Producer→ Wholesaler → Retailer→ Consumer

The total marketing cost of all intermediaries were found to be ₹ 2953.08 for timber/m³, 43.26 per pole and 270.65 per fuel wood/ton respectively.

The total market margin of all intermediaries was found to be ₹ 3915 per timber/m³, ₹ 27 and ₹ 460 respectively.

CHAPTER I

INTRODUCTION

1.1 Background Information

Teak have been derived from the Portuguese name teca, a derivative of Greek word tecton, "a carpenter". Grandis, in Latin means "large". Teakwood has long been considered the "carpenters pride". The common name of teak is 'Sagwan' and Botanical name is *Tectona grandis*, and it belongs to family Verbenaceae.

Teak is one of the most important and valuable indigenous timber trees of India. It is deciduous species occurring naturally below 24° N latitude in states of Kerala, Andhra Pradesh, Karnataka, Orissa, Madhya Pradesh, Maharashtra, Gujarat, Rajasthan, Uttar Pradesh and also in Manipur of India (Troup, 1921). The total area of natural teak forests alone in India is 8.5 million hectares (Tewari, 1992).

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). Tree planting activities were expanded with the introduction of the taungya system for teak plantation-a method of establishing a forest crop in temporary association with agricultural crops, 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, 1992).

Teak tree is large to very large deciduous tree having height up to 35 meters, bark having brown or grey colour and shallow longitudinal furrows; Leaves simple, opposite, broadly elliptical or obovate, acute or

acuminate, coriaceous, possessing minute glandular dots; Flowers white, many, small, having pleasant smell, in large erect terminal branched tomentose cymose bladder like calyx; seeds usually 1-3, ovate, marble white.

Teak is moderately fast growing species. It grows faster in initial years but slows down afterwards (Dhanesh Kumar *et al.* 1997; Jha, 1995; Negi, 1996). This species is pronounced light demander, intolerant of shades and requires complete overhead light. It is very sensitive to mutual root competition and to suppression by weeds. It is tender to frost and severe drought. Teak does not thrive under too hot or too moist conditions. In lower rainfall areas teak growth is poor. The tree is wind firm and fire resistant. It has remarkable ability to regenerate by coppicing and pollarding. The leaves are non palatable to grazers and browsers but attack by insects, Roots are liked by rats and pigs. The bole is tall, straight, fairly cylindrical and with age moderately fluted and buttressed.

Teak is deciduous tree, losing its leaves in November, December or early January in the dry and hot situations, however where the ground is moist, the tree may remains green until March or even later. The new foliage comes out in May. It flowers from June to August or September depending upon the climate and locality. The fruits ripen from November to January and fall gradually, some remain on the tree thought the season. The tree seeds well almost every year. The seeds are collected underneath the trees during January-March by sweeping.

The maximum and minimum temperatures in southern moist teak plantation areas especially on the Western Coast are 39 to 43°C and 13 to 17°C respectively. In the dry zone teak areas of Central India the maximum temperature is 48°C and minimum 2°C (Tewari, 1992).

Teak grows well in deep, well drained alluvial soil (Kulkarni, 1951; Puri, 1951). Hard literate soil and clays soil are unsuitable for the growth of teak. The optimum soil pH where teak is cultivated or

grows naturally varies from 6.5-8.0 (Kulkarni, 1951). High clayey soil, water logged and low lime content soils are unsuitable. Calcium and phosphorous content in the soil are essential for optimum growth of teak (Bhatia, 1954).

Teak is found to grow normally where the precipitation ranges from 800mm-2500mm. Seth and Khan (1958) have classified teak forests on the basis of rainfall range. Based on this most teak plantations were taken up within the natural teak growing areas. Teak grows well from sea level to a height of 1200 meters above msl. However, plantations are taken up mainly in the well-drained areas (Alexander *et al.* 1987) and undulating hill slopes as seen in the lower slope of Western Ghats, Aravalli and the Vindhya ranges.

Growth and quality of teak in plantation is largely depends on soil character, climate and management practices (Centeno, 1997) which includes latest impetus on intercropping

Large-scale commercial cultivation of teak was taken up during the 1960s, and followed by various forest development corporations during the seventies as per the recommendations of the National Commission on Agriculture (Anon, 1974).

Teak has the propensity to produce adventitious branches and epicormic shoots next to the scars caused by pruning. To prevent their development, pruning should be carried out just after period when most new leaves are produced (Centeno, 1997).

Commercially three distinct types of teak have been recognized-forest grown, forest plantation grown and orchard teak. In teak orchard higher growth rate is achieved due to better aeration and irrigation during non-rainy season, timely fertilizer application and protection from litter burning and fire damage (Reddy, 1995). Since trees once established do not respond significantly to irrigation and fertilizer application (Rawat, 1995) these operations should be carried out only for 3 to 5 years. The best way to ensure this is to go in for

intercropping with agricultural components in the beginning and shade loving cash crops later. This will ensure irrigation, hoeing and fertilizer application in earlier years and in turn benefit the tree crop. This has been observed in Teak and Poplar plantation (Dagar *et al.* 1995; Jha and Gupta, 1991; Lahiri, 1989).

Today total area under teak plantations in the world is estimated at 3 million ha (Centeno, 1997). India has over 0.5 million ha of teak plantations and massive ongoing programme to plant about 5000 hectare annually (Khullar, 1995).

Until the late sixties different state forest department were the sole agencies growing teak plantations within the country. Commercial teak plantations were raised for the first time by Maharashtra Development Board in 1968. On the basis of recommendations made by the National Commission on Agriculture, Forest Development Corporations which are basically public limited sector companies raised commercial plantations in large scale. At present, organization such as Forest Development Corporation of Maharashtra have raised about 0.165 million hectares of teak plantations from 1968–1998. Teak is being grown in plantations in more than 36 tropical countries across the globe although its natural occurrence is limited to India, Laos, Myanmar and Thailand. Of the estimated 205.1 million hectares of global productive planted forests in 2005, about 8.2 million hectares (4 per cent) were teak, representing a major portion of the words high-quality tropical hardwood plantations. The trend in the establishment of planted forests for productive function has increased from 1.7 per cent yearly in 1990-2000 to 1.9 per cent yearly in 2000-2005.

These plantation programmes were successfully raised by obtaining finance in the form of loans from organizations such as National Bank for Agricultural and Rural Development Bank and The World Bank. In Maharashtra productions of timber in 2009-10 was about 1.88 @ lakh cubic meter valued at ₹ 174.8 crores. Firewood comprises 4.32 lakh cubic meters during 2009-10.

Plantations are an important source of timber to narrow the growing gap between supply and demand for teak.

Teak is widely used as a lumber for ship building, furniture and general carpentry (Akindele, 1989; Weaver, 1993). Many authors have described its uses in detail (Purkayastha, 1985; Weaver, 1993; Kadambi, 1993; Negi, 1996 and Tewari, 1992).

Young tree provides small timber and poles, tree bark is used for getting yellow dye and the leaves are used for packing, preparing crude plate and rough umbrella. Leaves also make good quality compost.

Yield of teak generally depends on rotation, harvesting cycle, of the crop which varies from forest types to management systems. In most of the areas where teak occurs in mixed stands and the crop is an almost even aged rotation range from 70 to 150 years. In coppice or coppice with standard system, generally in drier localities, it is 40 to 60 years. The plantation crops are managed at 50 to 80 years. Recently harvesting cycle has drastically been reduced to 20 to 30 years with coming up green gold venture emphasizing on agro commercial farming of teak. In tropical America also most of the plantations are managed with this far shorter rotation (Centeno, 1997).

Teak has probably been cultivated for centuries in Asia and has been planted for timber production in India and Burma since at least 1840 (Troup, 1921).

Teak wood is famous world over for its strength, durability, dimensional stability, working qualities, and the fact that it does not cause corrosion when in contact with metal (Troup, 1921).

The productivity of a plantation can be largely improved through the selection of a correct site for the plantation programme. It is noted that the teak distribution pattern in its natural range is discontinuous or patchy type (Troup, 1921). Size, quality, density, and the form of teak trees vary from one location to another. There are several factors

which control the distribution and growth pattern of the species. The major factors include the amount and distribution of rainfall and moisture, soil and light.

Teak plantations have been widely established throughout the tropics with the main objectives to produce high quality timber within a period of 40-80 years. In general, the productivity of the teak plantation is 8-10m³/ha/year. Three main factors affect growth and quality of the plantation, site quality, seed supply and silvicultural management.

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: Mandal and Chawhaan (2003), for example, advise that efforts should be made to increase specific gravity, since any small gains 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.

Teak plantation is generally not followed by the farmer due to variety of regions and difficulties. The farmers are required to take risk and wait for more than 10 year for getting yield. Villagers have been planting tree for fuel, fodder, fruits and timber at their private holding and ripping benefits there from since ages. The technical guidance about improved practice of teak cultivation is provided by the extension workers of Forest Department and a financial help by the Government for raising teak plantation.

1.2 Need and importance of the study

Continued rapid growth of the construction sector and teak reputation as a high quality timber suitable for a wide array of uses has increased its demand. Whether the production is consonant with the demand, what are marketing opportunities exist for Teak timber how best we can manage the teak plantation.

It was therefore, felt necessary to study production and marketing of teak with this in view, the present study was undertaken with the following objectives.

1.3 Objectives of the study

- 1) To study the socio economic characteristics of teak growers
- 2) To estimate the establishment and maintenance cost of teak plantation.
- 3) To worked out the cost and returns of Teak plantation.
- 4) To study the marketing of teak.

1.4 Scope and limitations of the study

The present study was restricted to the teak plantation only. It was undertaken in Akola district for identifying the production and marketing of teak cultivation by teak growers. Efforts were made to find out the production and marketing of teak.

The identified constraints will indicate the probable difficulties in production and marketing of recommended technology of teak plantation and help in finding out appropriate solutions to overcome them.

The findings of the study will definitely be helpful to teak growers. The findings will also indicate about the need for training of teak growers.

A mention is to be made here that the findings of the study are based on the response of 60 teak growers of Akola district hence, the result are applicable to similar type of situation. Secondly the findings identified in the study were as per the opinion of teak growers only. A further probing by collection of information from researcher, input suppliers and other agencies engaged in timber trade is necessary.

1.5 Hypothesis of the study

The farmers have come forward for commercial teak cultivation on their individual lands. To increase the productivity and profitability of these plantations, adoption of recommended practices is necessary. The knowledge of practices will help to improve the profitability of the plantations.

CHAPTER II

REVIEW OF LITERATURE

Mathur *et al.* (1984) conducted study to examine the economics of eucalyptus plantation with special reference to Uttar Pradesh. They selected 116 hectare of eucalyptus plantation, planted on 13 different plots during 1971-73. They observed that, the eucalyptus plantation which were exploited in the year 1981-82 gave a yield of 4895 and 9518 m³ of log and fire wood, respectively. They concluded from the study that growing of eucalyptus was economically justified.

Mathur *et al.* (1984) studied an economics of eucalyptus as agro forestry plantation. They observed that the cultivation of eucalyptus on wider spacing in combination with agricultural crops at eight years of rotation ensure higher economic returns.

Sandhu and Singh (1986) studied the economics of *Acacia nilotica* considering the rate of ₹ 400/m³. The gross income from this crop was ₹ 58665.50/ha. The cost of planting was ₹ 2500 for the plant and the land rent was ₹ 1500 per annum for the entire area of plot.

Rawat (1988) examined the economic consideration in eucalyptus farming by developing a model for a eucalyptus farm managed by a profit maximizing owner. He determined the cost of planting diameter distribution of crop at various ages and densities, market price of the output, discount rate, the most economic combination of initial density and rotation age were the factors for consideration in management of tree crops.

Shukla *et al.* (1988) conducted study on cost benefit analysis of eucalyptus farming in Uttar Pradesh with special reference to Kanpur. The results of the study indicated that, 30 per cent of the return from eucalyptus could be obtained in 6 to 8 years. The average per hectare cost of cultivation of eucalyptus worked out to ₹ 55,524 and yield a net profit of ₹ 3,06,976 after eight years, besides purifying the atmosphere and improving the soils. They observed that inspite of so much profit

from eucalyptus poor cultivators cannot spare land for eucalyptus and wait for eight years to reap the benefits. Hence, the study suggests that, social lands and panchayat lands could be used for its cultivation and the income generated be used for village development.

Ahmed (1989) conducted study on economics of eucalyptus in agro forestry and its effects on agricultural production. His study revealed that out of three rotations of eucalyptus in agro forestry, one gave the maximum internal rate of returns (IRR) with minimum loss to agricultural crops.

Dilip kumar (1990) examined the implications of applying the economic criterion to the management of teak plantation and shows a positive net present value on sqIII for fairly high interest rates, up to 18 percent for the near and 15 percent for distant, hectares for sqIV. However even the fully stocked plantation becomes a net loss, when the interest rate was at or above 7 percent for near, and 5 percent for distant hectares, long rotations of 75 years or more through not optimal, skill shows a positive net present worth up to moderately high interest rates on sqIII, below 14 percent for the near and 11 percent for distant, hectares on sqIV, the 75 year rotation has a positive net present value (NPV) as long as the interest rate was below 6 percent for the near, and 5 percent of the distant hectare. The rotation of optimal SE fails to below 75 years for interest rates of around 4 percent expect for the distant sqIV hectare which however was completely unprofitable at 5 percent the better the expected returns, the greater was the tendency for economic criteria to contact the optimal rotation.

Negi *et al.* (1990) in their study clearly indicated that the biomass production and distribution of nutrients in 20 years old teak and gamar plantation in Telimura forest division in Tripura state during January, 1989. The results of the study indicated that the productivity of teak comes out to be 69/tonnes/ha/year and 8.2/tonn/ha/year for gamar.

Nandagoudar and Mutanal (1992) worked out the performance of teak in agro forestry. Their studies on agri-silvi-horti-pastoral system to introduce teak in arable land was initiated on red gravelly soils of Dharwad (Karnataka) under rain fed conditions during 1984, comprising of field crops, fruit crops (Papaya) and pasture crops (Subabul and guinea grass). At the end of 5 years 60 months, the height, DBH and estimated value of teak were higher, when teak was grown along with field crops and papaya as compared to further addition of pasture crops. In 57 months time, teak grew to a height of about 6 m with 7.4 cm DBH, useful as beams for several agricultural implements handles for tools and poles for various purposes. Higher height increment was observed up to 23 months after planting and between 50 * 57 months in treatment without grass or subabul.

Jayashankar and Muraleedharan (1993) studied the marketing of bamboo grow in the forest and also in the homesteads and farmlands in Kerala. The common species found was *Bambusa bambos*. They found that marketing of bamboo comprised of long chain of vertical interaction involving farmer, traders, contractors, agents and consumer in Kerala for bamboo market. They also found three marketing system. In first stage households, sell bamboo to the agents where in price varied from ₹ 5 to ₹ 40 per culm. In the second stage the agent felled the bamboo clump by himself or employing bamboo cutters. Bamboo was cut into 2 to 3 pieces depending on the size and shape of the culms. In the final stage, the depots sell bamboos to the consumers. The value of full bamboo which was sold in pieces ranged between ₹ 17 and ₹ 70. The net profit margin for the dealers varies from ₹ 10 to ₹ 15 per full bamboo.

Marawar *et al.* (1993) worked on socio economic analysis of farm forestry of Vidarbha region by selecting 25 farmers from 16 villages of seven districts of Vidarbha. The study examined the economics of eucalyptus grown under farm forestry and constraints faced by farmers in growing tree crop. The findings of the study reveal

that a majority of the growers who had raised plantations belongs to higher socio economic strata of the society with strong reserve base. Further they observed that eucalyptus cultivation employed about 213 days per hectare in eight years. The per hectare net returns after compounding at 15 percent was ₹ 11030 after eight years of rotation.

Prasad (1993) conducted study on economic analysis of *Acacia auriculaeformis* plantation in Gaya district of Bihar. The result shows that the survival rate of *Acacia auricularformis* was only 20.27 percent. Still the internal rate of return (IRR) of the plantation was found to be 12.816 percent. Which means that this will earn back all cost invested on its plantation and exploitation and will pay us 12.816 percent interest for the use of ones money thus even after such a low survival percentage, the plantation of *Acacia auricularformis* is found to be economically viable scheme.

Agarwal *et al.* (1994) conducted a study to know the effect of plantation season and irrigation on the growth and yield of bamboo. They observed that, yield of bamboo could be increased by 30 to 50 per cent when, it was planted during spring season followed by irrigation, resulting in better economic returns.

Diaralal (1994) reveals that assuming 90 percent survival at rotation age and minimum support price of ₹ 870 per tonn. The popular plantation would give and gross return of ₹ 391500 per hectare .After accounting for the interest on investment, the net return ranges between ₹ 235924 to ₹ 258958 per hectare.

Negi *et al.* (1994) conducted a study of eucalyptus marketing in India (Punjab). In a case study in Punjab, the results of the study confirmed the theoretical relationship of decline in producers share in consumer's rupee, with increase in length of marketing chain. Intermediaries were found to be significantly high. The study suggests the need for reviving marketing system and also keeping policy promises to maintain farmer's enthusiasm for the success of any innovative farm forestry plantations programme.

Shammugharvel (1994) worked out a preliminary report on economics of *Bambusa aruntinances* plantations. The results showed that, the net surplus of ₹ 109000 was obtained from one hectare of the plantation after five years. So the profitability of bamboo cultivation would be of the order of ₹ 21800/ha/year, while it may be favorable in comparison to most rain fed crops and cannot ignore the 5 year waiting period of bamboo cultivation vis-à-vis ordinary field crop. From plantation of fresh culm production, we can expect more yield in the second felling cycle and prices of bamboos remaining the same. The financial return also can be expected to be as good.

Chaturvedi (1995) studied teak plantations in India were divided into four site quality classes I, II, III and IV, depending on growth which varies according to end climatic condition. The best quality was I and the poorest was IV. Intermediate classes I/II, II/III and II/IV were also recognized. Thus, of site Quality Tables were made available. Trees were measured for girth or diameter at 1.38 m above ground referred to as girth or diameter at breast height.

Chaturvedi (1995) studied on prime quality of teak found in Myanmar and the Indian states of Karnataka and Kerala is obtained after at least 50 to 60 years under ideal conditions. A teak company's projection of an average volume of 1.06 m² per tree at 20 year at stocking rate of 927 stems per hectare is 16 times more than the volume obtained at 20 years in the most productive plantation in India. A teak tree with a volume of 1.06 m³ would have a diameter of about 50cm, which is obtained in prime quality teak at about 45 years. At this age the usual number of trees per hectare is about 100 compared with the company's projection of 927 trees per hectare at 20 years the total projected volume, 982.6m³ per hectare implies on extremely unrealistic mean annual increment (MAI) of 49.1m³ per hectare.

D. V. Singh (1995) conducted study on role of forests in rural economy of Himachal Pradesh. He reveals that rural household of the state receives 83 quintals of fodder 44.34 quintals of fuel wood and

0.25m³ of timber per annum from forest. The average tribal family receives 229 kg of minor forest products. Forest accounts 28 percent share in total family income of a man. This amount excludes value of timber used in packing the average returns from forests lands worked out vary from ₹ 5595 on large farms to ₹ 9038 on medium farms.

Gogate *et al.* (1995) worked out critical assessment of series of high input teak plantations established by Divisional Manager, FDCM Ltd., Thane Division. Application of irrigation and fertilizer had definitely showed positive response and has resulted in gains over rain fed plantations. Continuous monitoring of response to irrigation has revealed that expect during Juvenile stage, there was lack of response to irrigation during winter months i.e. period of dormancy.

Jaysankar and Muraleedharan (1995) conducting study of marketing of agro forestry products (bamboos) in Kerala. They observed that the bamboo form an important multiple tree species, which provide supplementary source of income to the farmers in Kerala. The increased farm prices of bamboos are mainly due to (i) the existence of lesser number of intermediaries. (ii) Several competitions between traders and (iii) steady demand. Growing demand from various sources increased the intensity of depletion of bamboos in the homesteads, the increased prices and marketing advantages can be motivating factors for taking up of bamboo cultivation in homesteads and farm lands.

Marawar *et al.* (1995) conducted study on economics of eucalyptus grown on marginal land by collecting data from 28.39 hectares. The results of the study indicated that per hectare returns from eucalyptus was ₹ 21679. When it is sold for fire wood at the farmers should make efforts to sell eucalyptus as timber to earn higher returns even on marginal lands.

Mehta (1995) studied the commercial teak plantation of vanashree plantation, launched by orient resorts private limited. The plantation is situated on the border of naturally growing teak zone. An

area of 31.5 hectare was planted with 52751 seedlings allotted to investors, who have invested in total 480000 the financial analysis carried out by and revealed that the net present value (NPV) is ₹ 6857 the internal rate of return (IRR) is 30 to 35 percent and the benefit to cost ratio is 9.6.

Rawat (1995) in his study of value of a 20 year old irrigated teak plantation observed that the highest value of average teak tree obtained for density of 250 trees per hectare and anticipated price escalation of 15 percent annum was 40000 at a reasonable rate of price escalation. The value of average tree will be below ₹ 25000.

Reddy (1995) found that planting of teak under irrigated condition yields more timber than unirrigated condition in 20 years.

Sharma (1995) conducted a study of social forestry in Orissa and evaluated within the framework, taking into account both distribution and equity considerations. Socio-economic, economic and financial profitability and optimum rotation were determined for social forestry plantations of *Casurina equisetifolia* on the basis of present net worth and expectation value.

Agarwal and Dhavan (1996) conducted a study of economics of harvesting and marketing of bamboo. The study revealed that the revenue obtained was almost double the cost of extraction through site cost was not taken into account. But as the bamboos can be harvested after 3 to 4 years and every year onwards, it seems to be very profitable venture for the plantation purposes. If the plantation cost is estimated as per the site specific, it was found to be within the amount ₹ 10000 per ha, for first two years including site preparation, planting and cultural operation then the growing of bamboo was found to be definitely a positive investment.

Haque (1996) worked out on teak wood plantations in 20 hectares of wastelands in Anthigur block with a plant protection of 10000 trees ha⁻¹ by using 1 X 1 meter space. The per hectare unit cost

up to 5 years was estimated at ₹ 60000 taking into the survival rate at 80 percent about 8000 trees were to be available for harvesting about 50 percent of the standing trees were to be cut in fifth year and the remaining trees were to be cut in ninth and fourteenth year. The returns of more than ₹ 50000 per tree in 20 years with investment of 1000 were worked.

Negi *et al.* (1996) worked out eucalyptus marketing in Punjab. They confirmed the established relationship in the marketing literature of decline in producers share with the increase in the length of marketing chain. However, farm products including farm, forest tree products, do need a considerable amount of processing before these can be passed on to consumers. Therefore, results also could be taken to suggest the need for identifying suitable marketing system and improve efficiency of the same. Improvement in the market infrastructure, e.g. establishment of pulp and paper mills and market intelligence would, therefore, go a long way in improving farm tree marketing system in the state. Gains of developed marketing infrastructure can be gauged from this comparative analysis of three markets where developed markets allow relatively higher producers share in the consumer rupee.

Murugesu *et al.* (1997) Study was carried out at the Forest college and Research unit (Tamilnadu) to elicit information on the growth and yield of teak (*Tectona grandis L. F.*) under irrigated condition. The oldest (11 year) available irrigated teak had a mean value of 0.109 m^3 (3.85 ft^3) tree¹ with mean annual volume increment (MAI) of 0.0099 m^3 tree¹. Based on this, the volume at 20 years was extrapolated to be 0.199 m^3 (7.00 ft^3) tree¹. Based on the diameter class of 11 year wood lot, only the diameter class of 15.1 – 25.0 cm was expected to attain a girth of 90 cm in 20 years and trunk with a GBH of 90 cm and above alone was considered as a log. This class of trees accounted for only 13.7% in 11 year wood lot raised.

Anon (1998) reported that the size (girth and length) are two major factors affecting the price of teak logs besides market and other factors. In India the price of teak timber has been increasing by 13-18 percent annually. The price of teak logs with mid girth more than 90 cm in northern part of India during October, 1998 varied between \$US 540 to 1008 per cubic meter. Teak logs of Nigerian origin were relatively cheap at \$US 630 per cubic meter. While teak logs from natural forests in Maharashtra fetched the height of \$US 1093 per cubic meter, logs of smaller dimension with mid girth 61-90 cm fetched price between 400 to 600 US \$ per cubic meter.

Decamino *et al.* (1998) studied of teak plantation in Costa Rica quoted an internal rate of return (IRR) of 12 percent where MAI (mean annual increment) was assumed to be $15\text{m}^3/\text{ha}/\text{year}$ and rotation 25 years. An analysis of different assumptions of MAI, rotation length, price and costs showed the sensitivity of IRR to these factors and emphasized the importance of reliable estimates.

Krishnan *et al.* (1998) conducted study on relative economics of tree and agriculture crops in Pondicherry by selecting 30 farmers from ten villages. The results show that the rate of return for sugarcane is greater among agricultural crops. But the rate of return from tree crops even after combining with inter crop is found to be lower than agricultural crop.

Krishnapillay (1998) reported that the IRR for a 15 year rotation teak was 17 percent for large scale plantation and 16 percent for small scale but the study noted that, even allowing for income from thinning, small scale farmers were unlikely to be able to afford to wait so long for a return on their capital. A mixture of rubber and teak, however grown on small scale on 20 years rotation gave an annual income from latex from early in the rotation and was calculated to give an IRR also of 16 percent and benefit cost ratio of 1.5, while remaining viable even at 20 percent reduction in revenue.

Odoom (1998) studied hardwood plantations in Ghana and noted a benefit cost ratio at 10 percent discount rate on fertile sites in the moist semi-deciduous zone of 2.4 (large scale > 100 ha) and 4.9 (small scale <10 ha) and in the forest savanna transition on poor sites of 0.8 (large scale) and 1.9 (small scale). The same favorable results with small scale farmers were reported for financial rate of return of 15 percent for large scale farmers and 20 percent for small scale, due to the assumed returns from inter-cropping with cash crops to give returns in the early years of the rotation.

Bhople R. S. *et al.* (1999) studied constraints faced by growers adoption of recommended practices of teak cultivation in Akola district practices like method of planting, spacing number of plants per hectare were studied.

Mohan Jha (1999) studied the comparative growth and economic returns from rain fed and irrigated teak plantations. His study reveals that teak plantation can fetch ₹ 100000 per hectare and the discounted value of which at 14 percent rate is ₹ 43070 whereas sale price poles obtained from non-irrigated plantation is ₹ 50000 and discounted value of which at 14 percent rate is ₹ 21060. Net discounted profit from one hectare irrigated teak plantation in 8 year is ₹ 25756 and in non irrigated plantation is ₹ 11288. Benefit cost ratio in non-irrigated plantation is 1.48 where as in non-irrigated plantation it is 1.15. Teak plantation is defiantly profitable because it can give net present value (NPV) ₹ 2500 in eight years.

Nandagoudar *et al.* (1999) in their study on economics of teak based agro forestry system report that, total income over five year period was higher with field crop + teak + papaya combination than pure field crop or pasture crop in addition to field crop, teak and papaya. Field crop + teak + papaya recorded a total income of ₹ 65098 per hectare followed by field crop + teak + papaya + subabhuil with ₹ 55853 per hectare. Income from field crop + teak + papaya combination was more by 33 percent than field alone.

Vasant. P. Gandhi (1999) revealed that there is a frequent mismatch between the supply and demand of different forest products and is believed to be substantially due to lack of good market information with both suppliers and buyers for correct decision making.

Andrew mittelman (2000) studied teak planting by small holders in Nakon sawan, Thailand. He observed that the average house hold planting is between 50 and 100 trees covering an area about 0.05 hectare and the projected net income for farm planted and mixed plantation. Teak compared with annual cash crop monoculture is higher i.e. 18000 US \$/ha after 10 years and 58000 US \$/ha after 20 years.

Balooni. K. (2000) studied on teak investment programs an Indian perspective. In his study he examines the growing importance of investment in tree plantation in India. The involvement of forest industries in raising plantations to meet their raw material requirements and the myths and realities surrounding teak investment programs. The many forest based industries are entered into arrangements with farmers to meet their raw material requirements by providing financial and technical assistance for initiating and maintaining plantations on private lands that leads to improve the socio-economic status of farmers.

Maldonado. G. (2000) studied the challenges of teak in Cote d ivoire. He analyses the choices made by Cote d ivoire with regard to teak production. It looks at relevant issues of national forest policy and international trade and approximately 90 percent of the country's teak plantations belong to the state with the remaining 10 percent made up of small private and village plantation.

Rajesh. K. Rana *et al.* (2000) reported that the every rupee invested in the plantation of agro forestry trees in eroded soils generates highest returns of ₹ 2.59 (B-C ratio) in case of *Delbergis sissou* and lowest of 1.97 for *Albizia lebbek* (*siris*). *Grewia optiva* which had the high net present worth had a benefit cost ratio of only 2.35

because of heavy labour cost for looping from 8th to 20th year of plantation. He revealed that benefits in agro forestry plantations are heavily discounted as compared to the corresponding costs due to the reason that benefits accrue in the later years while costs in the initial years. However plantation of all the three agro forestry trees were found to be profitable.

Schminke. K.H. (2000) reported a commercial teak plantation enterprise in Costa Rica and found that the first plantations with wide spacing will have only two commercial thinning in years 13 to 15 and 20 to 22, and as the final cut takes place between years 25 and 30. (1.2 million to 1.8 million m³ of high value timber will be harvested from the area for each rotation cycle)

Yadav *et al.* (2003) studied the economic evaluation of agri-silviculture under irrigated condition in Bundelkhand region. The study revealed that the average annual net returns from teak, neem and safed siris based agro-silvicultural system were ₹ 70121, 25621 and 5919 respectively, while the traditional cropping system had a net return of ₹ 5261.

Aiyeloja *et al.* (2006) studied on non timber forest products marketing in Nigeria. His study reveals that the marketing channel for chewing stick (*Zanthophyllum zanthoxonoides*) links the wholesaler directly or in some cases passes through the processor who does the splitting where it passes to the wholesaler directly. The wholesaler does the washing, cross cutting and splitting before selling to the retailer. The retailer may re split before dividing them into smaller units (bunches). There is no direct link between the producer or processor and the consumer in case of *M. acuminata* through this may exist in other types that are widely marketed.

Ansari and Singh (2007) reported that higher survival rate is positively correlated with net present value (NPV) and internal rate of return (IRR) as it was true in case of Barkoli plantation of 21 years old

teak recorded maximum NPV at 12 percent rate and IRR is 31.20 percent.

Nagpure S.C *et al.* (2007) reported that per unit cost of marketing of all types of teak products (timber, pole and fuel) was highest in channel-II followed by channel-III and I. Through channel-II, gross marketing margin was higher in sale of teak timber (42.63 per cent), teak pole (44.82) and teak fuel (57.47 per cent). The producer share in consumer rupee was highest in channel-I (99.28 per cent) followed by channel-II and III, which implied that channel-I was most profitable channel due to elimination of middleman.

CHAPTER III

METHODOLOGY

Application of sound methodology which is of vital importance in any scientific investigation. It forms a basis of study to arrive at the final conclusions. It comprises Sampling technique, method of data collection, analysis of data by applying appropriate statistical tools, interpretation and presentation of the results. Different technique and methods adopted in the study are presented in the chapter.

The chapter deals with the sampling technique, method of collection of data and analysis of data which forms a basis of any scientific study to arrive at the final conclusions.

3.1 Selection of area:

Akola District was purposively selected on the basis of teak growers of area on teak plantation.

3.2.1 Sampling technique:

Multi stage sampling technique was used i.e. in first stage Akola district was selected and in second stage three tahsils were selected in Akola district i.e. Akola, Patur and Barshitakali and sixty teak growers were selected in these tahsils.

3.2.2 Sample size:

Total 60 teak growers were selected purposively for teak plantation and 15 wholesalers and 15 retailers were purposively selected for teak marketing.

3.2.3 Types of data:

The primary data was selected on the basis of marketing.

3.2.4 Data collection:

The data on the relevant aspects such as area under teak, inputs used in cultivation and marketing cost and market margin of cultivators were collected from sample teak cultivators by survey

method by conducting personal interviews on specially designed questionnaire prepared for study purpose.

3.2.5 Study period:

The data pertained to the year 2009-2010.

3.2.6 Analytical tools:

Simple tabular analysis was used such as mean, frequency, averages and percentages etc. and Cobb-Douglas type of production function was fitted for work out resource use efficiency.

$$Y = a b_1 X_1 b_2 X_2 b_3 X_3 \dots \dots \dots b_n X_n e^u$$

Where,

Y = Output of teak as dependent variable((Qtls.)

X₁= Total human labour (man days)

X₂= Total bullock labour (pair days)

X₃= Expenditure on manures (₹)

X₄= Total fertilizers (₹)

X₅= Plant protection expenditure or charges (₹)

X₆= Irrigation charges (₹)

b_iⁿ= Regression coefficients

a = Constant

e^u=Error term.

The significance of regression coefficient of each of the independent variable was tested with the help of students't' test. The goodness of fit of the model and appropriateness of the variables was tested with the help of coefficient of multiple determination (R²).

In order to know net price realized by teak cultivators, it is required to take in to consideration the cost of marketing as one of the major cost component. The following items were considered while calculating marketing cost.

- i) Grading charges
- ii) Processing charges
- iii) Felling of trees and trimming
- iv) Transportation cost (including loading and unloading)
- v) Different market charges and
- vi) Share of different agencies involved in the marketing of teaks

Thus, marketing cost and net price realized by the cultivators was worked out.

3.2.7 Cost concept:

Cost A:

It is the actual paid out by the cultivator in the form of cash and kind. It approximates the actual expenditure incurred by the farmer.

This cost includes the expenditure on the following items.

1. Hired human labour (family / hired)
2. Bullock labour (Owned / hired)
3. Value of seedlings
4. Value of manures (Farm produce / purchased)
5. Value of Fertilizers
6. Value of seedlings
7. Plant protection
8. Irrigation charges
9. Land revenue and other taxes.
10. Depreciation on capital assets

11. Interest on working capital
12. Miscellaneous expenses.

Cost B:

Cost A + Interest on fixed capital + Rental value of owned land.

Cost C:

It is the total of direct as well as imputed costs including the imputed value of family labour. It is worked out by adding the imputed value of family labour to cost B.

A) Human labour

It is the actual paid out cost by the planter in the form of cash and kind. This cost includes the expenditure as human labour, planting material, plant protection, value of manures and fertilizers, depreciation, interest on working capital and miscellaneous expenses.

B) Irrigation charges

The amount spent on the maintenance of electric motor for irrigating the crop, depreciation and the hours of use were considered for estimating the irrigation charges in case of well irrigation. The actual irrigation charges paid by the cultivators were taken into account.

C) Land revenue, cesses and taxes

This cost includes land revenue and other relevant taxes and cesses which were actually paid by the cultivator.

D) Depreciation on implements, machinery and farm buildings

From assets like implements and farm buildings were evaluated at the prevailing market prices taking in to consideration the condition of assets. Depreciation of these assets for the current year was calculated using straight line method. For this, the present value and remaining useful life of assets was considered.

E) Interest on working capital

Interest on working capital was charged at the rate of 12 per cent per annum. Working includes cash or kind expenses incurred during the period of cultivation.

F) Bullock labour

Bullock labour cost was calculated by considering the maintenance cost required for pair and the productive employment days. In case of hired bullock labour the hired charges paid by the farmers on his account were considered.

G) Machine labour

In case of owned machines, cost is evaluated on the basis of hired charges prevailed in the village and in the case of hired machines as per actual amount paid.

H) Value of seedlings:

The cost of seedlings was evaluated at actual expenses incurred on seedlings.

I) Manure

The cost of farm yard manure (FYM) or compost produced in the farm was evaluated at the rates prevailed in the village. The cost on account of manures purchased was accounted as the actual price paid by the cultivator.

J) Fertilizers

The fertilizers were evaluated at the actual price paid by the cultivator.

K) Insecticides and pesticides

The insecticide and pesticide expenses were considered at the actual price paid by the cultivator.

L) Interest on fixed capital

Interest on present value of fixed assets (excluding land) such as farm buildings, implements and machinery, irrigation structures, equipments and live stock (only drought animal) was charged at the rate of 10 per cent.

M) Rental value of land

This cost includes the estimated rental value of owned land. It was evaluated at the rate of $1/6^{\text{th}}$ of the value of the gross output minus the land revenue. In the case of cost of establishment of teak, rental value evaluated at $1/6^{\text{th}}$ of present value of land.

3.3 Economic feasibility of Teak

The project evaluation technique was used to measure the economic feasibility of teak by following measures.

Payback period	(PBP)
Net present value	(NPV)
Benefit cost ratio	(B: C ratio)
Internal Rate of Returns	(IRR)
Profitability index	(PI)

This technique measure the productivity of capital invested and for which the flows of costs and returns over the life period of the crop are required. These costs and returns or cash outflows and cash inflow from teak crops can be brought to refer to particular point of time i.e. present period by discount / compounding them.

3.4 Net present value:

The discount rate which reflects the price of the investment funds used to arrive at costs and returns to a common point of time.

These costs are subtracted from returns to get the net present value of the project.

A positive net present value indicates that the investment is worthwhile and the size of the net present value indicates how worthwhile the project is in utilizing the resource to maximize income,

$$NPV = \sum_{t=1}^n \frac{Rt - Ct}{(1+i)^t}$$

Where,

- R = Returns (NPWB)
- C = Costs (NPWC)
- n = project life
- i = discount rate

The decision criterions are profitability:

If $NPV > 0$ investment is worthwhile.

$NPV < 0$ investment is not worth while

$NPV = 0$ Indifferent case.

3.5 Pay back period:

It is the number of year an investment project takes to recover as cost from its returns.

3.6 Benefit cost ratio:

The benefit cost ratio measures the returns or benefits per unit of cost of investment using the same notations

$$BCR = \frac{\sum_{t=1}^n \frac{Rt}{(1+i)^t}}{\sum_{t=1}^n \frac{Ct}{(1+i)^t}}$$

The decision criteria are uses for profitability.

If,

$B - C > 1$, investment is worthwhile

$B - C < 1$, investment is not worthwhile

$B - C = 1$, indifference case

3.7 Profitability Index

It is a ratio of net present value of the project to the total capital expenditure.

Where,

C_0 - Initial capital investment

$$PI = \frac{NPV}{C_0} = \frac{1}{C_0} \sum_{t=0}^T \frac{R_t - C_t}{(1+i)^t}$$

3.8 Internal Rate of Return (I.R.R.)

The internal rate of return means the discount /compound rate at which the present value of returns equals that of costs. According to the derived discount rate (IRR - r) is compared with the price of the investment funds to know the worthwhile of the project.

$$\text{I.R.R.} = \text{Lower discount rate} + \text{Different between two discount rates} \left(\frac{\text{Net present value at lower discount rate}}{\text{sum of NPV at Lower discount rate and NPV at higher discount rate}} \right)$$

Profitability:

If,

$r > i$ investment is worth while

$r < i$ investment is not profitable

$r = i$ Indifferent case.

3.9 Marketing of teak:

3.9.1 Marketing cost:

This Cost involved in moving the product from the point of production to the point of consumption.

3.9.2 Marketing channel:

The study on marketing of teak conducted to know the existing marketing channel of teak in selected area of Akola district.

3.9.3 Marketing margin:

Profits of various market functionaries involved in moving the produce from the initial point of production till it reaches the ultimate consumer.

3.9.4 Price spread:

It is the difference between price received by producers and the price paid by consumers.

3.9.5 Producer's share in consumer's rupee:

$$Ps = \frac{PF}{Pr} \times 100$$

Where,

Ps = Producer's share in consumer's rupee

PF = Price received by the farmer

Pr = Price paid by the consumer

CHAPTER IV

SOCIO-ECONOMIC FEATURES OF AKOLA DISTRICT

Maharashtra state has six revenue divisions viz. Mumbai, Pune, Nashik, Aurangabad, Amravati and Nagpur. Vidarbha area includes Amravati and Nagpur revenue divisions comprising eleven districts viz. Buldhana, Akola, Washim, Amravati, Yavatmal, Wardha, Nagpur, Bhandara, Chandrapur, Gadchiroli and Gondia and Gondia are newly formed districts bifurcating Akola and Bhandara districts, respectively. Vidarbha as a whole contributes cotton, rice, jowar, millets, oilseeds, soybean, citrus, forest timber etc. to the agricultural production of the state.

The present study is confined to Akola district of Western Vidarbha. The agro-climatic conditions differ from, place to place and even in close vicinity also.

4.1 Location of Akola district

Akola district falls in Vidarbha region of Maharashtra. It comprises of seven tahsils. It lies between $20^{\circ} 17'$ and $20^{\circ} 18'$ North latitudes and $76^{\circ} 17'$ and $77^{\circ} 14'$ East longitudes. It covers area of 5417 sq. km accounting for 1.76% of the total area of Maharashtra. Akola district is surrounded by Amravati district in North apart of Amravati and Yavatmal district in East, Washim and Yavatmal district to the south and Buldhana district towards the west.

4.2 Topography and Soil

The northern part of the Akola district lies in Purna valley which itself is a part of Tapi river basin. River Purna has formed fertile basin in Akola, Balapur and Murtizapur tahsils of Akola. Akola district is divided in to seven tahsils for smooth administration. The district ranks 4th in respect of size and 5th in respect of population among the 11 districts of Vidarbha region of Maharashtra. The soil of the district is basically derived from volcanic trap rock and it is quite fertile. It is



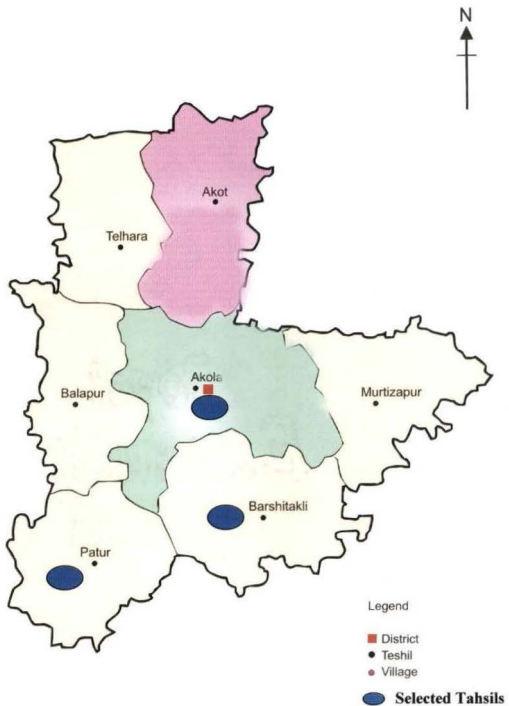


Fig. 1 : Map of Akola district showing tehsils selected for study

classified into categories as coarse soil found in south, medium black soil found in the plain and deep black soil found in river valley.

-4.3 Climate and rainfall

Being away from the sea, the district experiences extremities of the climate. The weather during winter is too cool. While in summer it is too hot. The average minimum and maximum temperature extremities observed throughout the year were 10⁰C, respectively. Akola district falls in assured rainfall zone of Maharashtra state having average rainfall between 750 to 1000 mm.

4.4 Population and Literacy

The total population of Akola district is 16,30,239 (2001 census). Out of which male population is 8,41,203 (51.60%) and female population is 7,88,986 (48.40%). The total literacy percentage is 81.17. Male and female literacy is 88.91 per cent and 73.43 per cent.

4.5 Land holding

Information regarding category wise land holding of Akola district is presented in Table.1

Table 1: Category wise land holding of Akola district (2005-06)

Sr. No.	Land holding (ha)	Land holders (%)	Area (%)
1	0-1.99	52.93	22.11
2	2-4.99	32.68	35.63
3	5-9.99	11.28	27.23
4	10-19.99	2.91	12.98
5	20-49.99	0.20	2.05
6	Above 50	-	-

(Source: District Socio-Economic Review 2005-06)

4.6 Land Utilization pattern

The information about land utilization pattern in Akola district are presented in Table 2

Table 2. Land utilization pattern of Akola district (2006-07)

Sr. No.	Particular	Area (ha)	Percentage to total
1	Total geographical area	531891	100.00
2	Area under forest	36759	6.91
3	Barren and uncultivable land	17027	3.20
4	Permanent pastures and other grazing land	7435	1.39
5	Land under miscellaneous tree crops and grooves not included in net area sown	18800	3.53
6	Culturable waste land	5928	1.11
7	Land put under non-agricultural use	7087	1.33
8	Current fallow	8928	1.68
9	Other fallow	6226	1.17
10	Net sown area	423701	79.66
11	Area sown more than once	33744	6.34
12	Gross cropped area	457445	-
13	Cropping intensity (%)	107.96	-

(Source: District Socio-Economic Review, 2006-07)

4.7 Cropping pattern

The usual cropping pattern is determined by large number of factors. The most important factors are climate, soil, topography, customs and distance of the market and it is presented Table 3

Table 3 Cropping pattern in Akola District

Sr. No.	Crop	Area ('00 ha)	Percentage to total
1.	Rice	-	-
2.	Kharif jowar	718	14.39
3.	Bajra	9	0.18
4.	Maize	31	0.62
5.	Other cereals.	3	0.06
	Total cereals	761	15.25
6.	Tur	580	11.62
7.	Mung	676	13.55
8.	Urid	177	3.55
9.	Other Pulses	9	0.18
	Total Pulses	1442	28.90
	Total food grains	2203	44.15
10.	Groundnut	-	-
11.	Sesamum	40	0.80
12.	Sunflower	25	0.50
13.	Soybean	826	16.55
14..	Other oilseeds	7	0.14
	Total oilseeds	898	18.00
15.	Cotton	1886	37.80
16.	Sugarcane	3	0.06
	Gross cropped area	4990	100.00

(Source: Krishi Uthpadhan, 2009)

4.8 Crop season and crop rotation

There are two important crop seasons i.e. Kharif and rabi where as in summer season land generally remains fallow and preparatory tillage operations are carried out.

The manner in which crop rotations are commonly followed is presented in Table 4.

Table 4. Crop season and crop rotation

Sr. No.	Kharif season	Rabi season
1.	Cotton	-
2.	Cotton + Tur + Jowar	-
3.	Jowar	Gram
4.	Cotton + mung + udid	Wheat
5.	Cotton + Tur + mung	Gram
6.	Jowar	Safflower/wheat
7.	Cotton + Tur	Safflower
8.	Cotton + Tur + Jowar + Mung	Sunflower
9.	Mung	Safflower
10.	Cotton + Mung.	-

(Source: District Socio-Economic Review, 2006-07)

4.9 Input supply

Agricultural inputs like seed, manure, fertilizers, insecticides, pesticides etc. required by the farmers are made available to them through number of agricultural service centers established at district level and block levels.

Maharashtra state seed corporation and other private seed companies supply quality seeds to the farmers. The farm inputs are made available to the farmers by co-operative societies also. Functioning at block level, panchayat samiti also provides inputs to the farmers. Co-operative society supply input against the loan sanctioned by District Central Cooperative Bank to the individual cultivator.

Table 5 Credit Supply in Akola district

Sr. No.	Credit society	Number	Working capital (₹ in Lakh)	Loan given (₹ in Lakh)
1.	Primary Agricultural Co-operative credit Society	412	10180	495942
2.	Non- agricultural credit society	273	210392	5859
3.	Panan Sanstha	14	58783	-
4.	Production Society	395	-	-
5.	Social service society	683	-	-

(Source: District Socio-economic Review 2005-06)

4.10 Markets

For the marketing of agricultural produce, Agricultural Market Committees are functioning in the district. All seven tahsils having facilities of regulated markets in the district. These sub-markets are connected with roads and having facilities like banking, electricity and telephone communication etc. Bullock cart and tractor are main means of transportation of agricultural produce and inputs.

CHAPTER V

RESULTS AND DISCUSSION

Teak planting on manmade forest land is increasing at a faster rate and being encouraged by supply of nursery plants from the private forest nursery. Farmer's plants tree primarily for business considerations and the area is limited. Every land owner wants maximum income from his land. This requires maintaining teak trees for 50 to 100 years. Teak tree farming has become competitive than agriculture and horticulture. This cause for knowledge about the economics of teak plantation grown by the farmers on their farm using farm level data and minimizing the marketing charges.

5.1 Economic characteristics and management practices of selected farmers

The 60 teak growers have been classified according to various attributes of study. The attributes studied are family size, education, livestock pattern, cropping pattern and distribution of farm size, in addition to this, fixed investment, recommended management practices and marketing of teak followed by teak growers have been studied.

5.2 Average family size of teak growers

The farmers growing teak as an income source from the agricultural land have been studied for the family size. The number of males, female and children's in family of teak growers have presented in Table.6.

It is revealed Table. 6 the average family of selected teak growers is consisting of 2 males, 2 females and 1 child, indicating that selected teak growers are also following normal family pattern.

Table 6: Average family size of Teak growers

Sr. no.	Particulars	Avg. No. of persons	Percentage
1	Male	2.00	40.00
2	Female	2.00	40.00
3	Children(s)	1.00	20.00
	Total	5.00	100

(Figures in parentheses indicate percentage to the total)

5.3 Distribution of selected Teak growers according to Education

Table 7: Distribution of Teak growers according to Education

Sr. no.	Education level	Frequency
1	Literate	60 (100)
2	Primary school	6 (10.00)
3	High school	19 (31.66)
4	Graduate and above	35 (58.33)
	Total	60 (100)

(Figures in parentheses indicate percentage to the total)

The 60 growers have been classified according to their education level. It is observed from Table. 7, 100 per cent teak growers are literate. The further distribution teak growers indicate 10.00 per cent teak growers are educated up to primary level, 31.66 per cent up to high school level, 58.33 per cent teak growers are graduated and above. It is cleared from the Table. 7 that majority of teak growers (58.33 per cent) are having education level is graduation and above and as such their education level made way for knowledge of teak growing.



Plate 1 : Views of data collection at teak farm

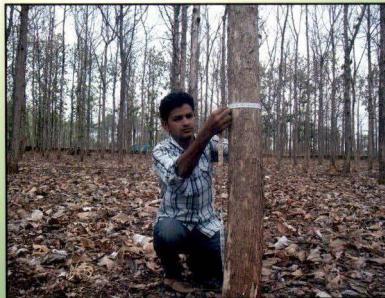


Plate 2 : Measuring the girth and length of teak

5.4. Distribution of teak growers on the basis of Occupation

Table.8.Distrubution of teak growers on the basis of Occupation

Sr. No.	Occupation	No. of growers	Percentage
A	Main occupation		
1	Farming	40	66.67
2	Contractor	2	3.33
3	Architect engineer	1	1.67
4	Doctor	7	11.67
5	Photographer	1	1.67
6	Shopkeeper (Medical, Agro seed etc)	5	8.33
7	Saw miller	1	1.67
8	Govt. service (teacher)	3	5.00
	Sub total	60	100
B	Subsidiary		
1	Farming	20	33.33
2	Krishi seva Kendra	3	5.00
	Total	23	38.33

The 60 teak growers have been classified according to their occupation and it is presented in Table. 8 that, 67 per cent of the teak growers main occupation is farming, 11.6 teak growers are Doctors and 6.33 per cent growers are shop keeper (Medical, Agro seeds. etc) 34 per cent growers subsidiary occupation is farming and 5 per cent are having Krishi Seva Kendra. This indicates that the 67 per cent majority of teak grower's main occupation is farming.

5.5 Tahasil wise distribution of area under teak to total area

The 60 teak growers are selected from 3 tahasils i. e. Akola, Patur and Barshitakali.

It is presented in Table. 9 indicates tahasil wise distribution of area under teak to total area. The Akola tahasil have 27 per cent area under teak, Patur have 51.32 per cent and Barshitakali 22 per cent area under teak.

Table 9: Tahasil wise distribution of area under teak to total area

Sr.No.	Tahasil	No. of villages	No. of growers	Total land (ha)	Area under Teak (ha)
1	Akola	15 (50)	25 (41.67)	194.95 (100.00)	18.64 (26.34) 9.56*
2	Patur	11 (36.67)	25 (41.67)	200.8 (100.00)	36.31 (51.32) 18.08*
3	Barshitakali	4 (13.33)	10 (16.67)	95.75 (100.00)	15.8 (22.33) 16.50*
	Total	30 (100.00)	60 (100.00)	491.5 (100.00)	70.75 (100.00)

(Figures in parentheses indicate percentage to the total)

*indicate percentage to the total land of respective Tahasil

5.6 Distribution of teak growers according to land holding under teak area

Distribution of teak growers according to land holding under teak area is presented in Table 10.

Table 10 reveals that majority of teak growers (72 per cent) have up to one hectare of teak area and only 4 per cent teak growers have 4.01 and above teak area.

5.8 Land use pattern of selected teak growers (Area in hectares)

The land utilization pattern of teak growers is presented in Table.12.

Table 12: Land use pattern of selected teak growers (Area in hectare)

Sr. no.	Item	Size of Holding (ha)	Percentage
1	Avg. size of land holding	8.33	
2	Fallow land	0.25	
3	Net cropped area	8.08	100.00
A	Irrigated area	3.57	44.18
B	un irrigated area	4.51	55.82
4	Area under teak	1.17	14.48
5	area sown more than once	2.39	29.58
6	Gross cropped area	10.47	100.00
7	Cropping intensity	129.58	

Table.12. reveals that, the average size of teak growers is 8.33 ha. Comprising of net cropped area 8.08 ha, further distributed unirrigated area 4.51 ha, irrigated area 3.57 ha, fallow land 0.25 ha. The percentage of irrigated area is 44.18 per cent and area sown more than once is 2.39 ha and cropping intensity 129.58 per cent.

Land utilization pattern indicates that on an average growers are medium having irrigated area 44.18 per cent area resulting in increase into cropping intensity 129.58 per cent.

5.9 Cropping pattern of selected teak growers

The cropping pattern influences the quantum of farm produce and dominated by the recent trend beneficial to the growers, in the light of this cropping pattern of selected growers have been presented in Table. 13.

Table 13: Cropping pattern of teak growers

Sr. no.	Seasons	Area in (ha)	Percentage
A	Agriculture crops		
1	Cottonn	1.23	11.75
2	Mung	0.41	3.92
3	soybean	3.02	28.84
4	Jowar	0.44	4.20
5	Tur	1.25	11.94
6	Udid	0.28	2.67
7	Maize	0.39	3.72
8	Wheat	1.01	9.65
9	Gram	0.63	6.02
10	Sunflower	0.08	0.76
	Sub total	8.74	83.48
B	Horticulture crops		
1	Chili	0.08	0.76
2	Onion	0.06	0.57
3	Cabbage	0.02	0.19
4	Lemon	0.28	2.67
5	Mango	0.12	1.146
	Sub total	0.56	5.35
C	Forestry Crop		
1	Teak	1.17	11.17
	Total	10.47	100.00

It is revealed from Table.13 that about 84 per cent area under agriculture crops of which 28.84 per cent soybean, 11.75 per cent cotton, 5.35 per cent under Horticultural crops. Among the horticultural crops area under lemon is 2.67 per cent. The area under t6eak is 11.17 per cent.

5.10 Capital investment by teak growers

The value of asset i. e. land, livestock's, implements and machinery for the selected teak growers is presented in Table.14.

Table 14: Capital investment by teak growers

Sr.no.	Particulars	Value of Assets	
		Per Farm	Per hectare
1	Land	1147285 (66.69)	144312 (66.69)
2	Livestock	63,982 (3.72)	8048 (3.72)
3	Implements and building	508986 (29.59)	64023 (29.59)
4	Total value of assets	1720253 (100.00)	216383 (100.00)

(Figures in parentheses indicate percentage to total)

It is observed from Table.14 that the asset value perform is dominated by land ₹ 1147285 (66.69 per cent) followed by investment in implements and building ₹ 508986 (29.59 per cent), live stock ₹ 63982 (3.72 per cent) indicating that implements, building and live stock are the major contributors of investment in farm.

5.11 Per hectare cost of establishment of teak plantation

(Preliminary year to 5th year)

The per hectare cost of establishment of teak plantation in Akola district is given in Table 15.

The Table.15 reveals that, the per hectare total cost of establishment of teak plantation in Akola district worked out to be ₹ 76335.45 for an initial period of 5 years. Breakup of the total cost of establishment at district level into conventional cost concept viz, 'A', 'B' and 'C' estimated at 71.63, 19.8 and 8.58 per cent, respectively. This

implied that, in the total cost of establishment of teak plantation direct cost dominance over that of indirect cost.

An in depth item wise analysis of total cost of establish of teak plantation revealed that ,the wages of human labour had the line share, contribution of this item done worked out to be 23 per cent. The next to this an important items of cost in order of the per cent share were rental value of land (17.70 per cent), bullock labour (12.18 per cent), family labour (8.58 per cent), manures (8.46 per cent), interest on working capital (7.45 percent), value of seedling (6.55 percent), fertilizer (5.70 per cent), plant protection (3.94 per cent), irrigation charges (2.19 per cent) and interest on fixed capital is 2.10 per cent. An expenditure incurred on rest of the items such as depreciation, land revenue, transportation of inputs is negligible.

The per hectare investment of teak plantation was found to be comparatively smaller, because quantities of inputs used were small. Similar conclusion found by Haque (1996).

Table 15: Per hectare cost of establishment of teak plantation
(Preliminary year to 5th year)

Sr. no.	Particulars	Unit	Unit required	Price/unit	Total cost (₹)	Percentage
I	Cost A					
1	Hired human labour					
A	Male	Days	135.5	100	13550	17.75
B	Female	Days	80.5	50	4025	5.27
	Total		216	150	17575	23.02
2	Bullock labour	Days	62	150	9300	12.18
3	Value of seedling	No.	2500	2	5000	6.55
4	Manures	Qtl	17	380	6460	8.46
5	Fertilizers	Tonn	0.87	5000	4350	5.70
6	Irrigation charges	₹			1670	2.19
7	Plant Protection	₹			3008	3.94
8	Interest on Working capital @ 12%	₹			5683.56	7.45
9	Depreciation	₹			1400	1.83
10	Land revenue and other cesses	₹			230	0.30
	Sub total				54676.56	71.63
II	Cost B					
11	Rental value of land	₹			13508.89	17.70
12	Interest on Fixed capital @ 10%	₹			1600	2.10
	Sub total				69785.45	91.42
13	Family labour					
	Male	Days	58	100	5800	7.60
	Female	Days	15	50	750	0.98
	Sub total				6550	8.58
III	Cost C (Total cost)				76335.45	100.00

5.12 Per hectare cost of maintenance of teak plantation (From 6th to 20th years)

The crop cycle of teak plantation under study in 25 years from the date of plantation of this period of initial five years is treated as gestation or establishment and from the fifth to twentieth year is assumed as period of maintenance of teak plantation, the total direct and indirect or imputed cost from fifth to twentieth year is treated as cost of maintenance.

The per hectare cost of maintenance of teak plantation in Akola district is shown in Table 16.

The Table 16 shows that. On an average per hectare cost of maintenance of teak plantation in Akola district was ₹ 234348.08 of this share of cost A, B and C was worked to be 14.14, 85.09 and 0.77 per cent respectively. This showed that, proportion of direct cost into the total cost of maintenance was comparatively lower (i. e. 14.14 per cent) than that indirect cost (85.09 per cent). An item wise break up of maintenance cost revealed that share of rental value was the highest (83.04 per cent) followed by wages of human labour (10.21 per cent) and interest on fixed capital (2.05 per cent) and interest on working capital (1.42 per cent). The combined contribution of these four items worked out to be 96.72 per cent. While the share of rest of the items viz. Manures, fertilizers, irrigation charges, land revenue and family labours were negligible

Table 16: Per hectare cost of maintenance of teak plantation
(From 6th to 20th years)

Sr. no.	Particulars	Unit	Unit required	Price/unit	Total cost (₹)	Percentage
I	Cost A					
1	Hired human labour					
A	Male	Days	186.50	100	18650	7.96
B	Female	Days	105.50	50	5275	2.25
	Total		292.00		23925	10.21
2	Bullock labour	Days				
3	Value of seedling	No.				
4	Manures	Qtl	1.8	380	684	0.29
5	Fertilizers	Tonn	0.38	5000	1900	0.81
6	Irrigation charges	₹			700	0.30
7	Plant Protection	₹			425	0.18
8	Interest on Working capital @ 12%	₹			3316.08	1.42
9	Depreciation	₹			1500	0.64
10	Land revenue and other cesses	₹			690	0.29
	Sub total				33140.08	14.14
II	Cost B					
11	Rental value of land	₹			194598	83.04
12	Interest on Fixed capital @ 10%	₹			4800	2.05
	Sub total				232538.08	99.23
13	Family labour					
	Male	Days	16	100	1600	0.68
	Female	Days	4.20	50	210	0.09
	Sub total				1810	0.77
III	Cost C (Total cost)				234348.08	100.00

5.13 Per hectare total cost of teak plantation (from 1st to 20 years)

The cost of teak production comprises the costs incurred from the preparation of site for teak plantation till final felling at an age 20th year from the date of teak plantation.

The per hectare cost of production of teak plantation in Akola district is presented in Table 7.

The Table 17 shows that, on an average per hectare cost of production of teak plantation in Akola district worked out to be ₹ 310683.53. In this share cost components such as cost 'A', 'B' and 'C' was estimated at 28.27, 69.04 and 2.69 per cent, respectively there by indicating dominance of imputed cost over the actual or direct cost. The proportion of direct an indirect cost into total cost of production of teak worked out to be 28.27 and 71.73 per cent, respectively.

An item wise distribution of cost of production revealed that, the rental value of the land (66.98 per cent) and wages of human labours (13.36 per cent) were most important items of cost of teak production and these two items had 80.34 per cent share in the total cost of teak production. The rest of items had only 19.66 per cent share in the total cost of production there by indicating their non significant contribution towards the total cost of production in the study area.

Table 17: Per hectare total cost of teak plantation

(from 1st to 20 years)

Sr. no.	Particulars	Unit	Unit required	Price/unit	Total cost (₹)	Percentage
I	Cost A					
1	Hired human labour					
A	Male	Days	322.00	100	32200	10.36
B	Female	Days	186.00	50	9300	2.99
	Total				41500	13.36
2	Bullock labour	Days	62	150	9300	2.99
3	Value of seedling	No.	2500	2	5000	1.61
4	Manures	Qtl	18.8	380	7144	2.30
5	Fertilizers	Tonn	1.25	5000	6250	2.01
6	Irrigation charges	₹			2370	0.76
7	Plant Protection	₹			3433	1.10
8	Interest on Working capital @ 12%	₹			8999.64	2.90
9	Depreciation	₹			2900	0.93
10	Land revenue and other cesses	₹			920	0.30
	Sub total				87816.64	28.27
II	Cost B					
11	Rental value of land	₹			208106.89	66.98
12	Interest on Fixed capital @ 10%	₹			6400	2.06
	Sub total				302323.53	97.31
13	Family labour					
	Male	Days	74	100	7400	2.38
	Female	Days	19.20	50	960	0.31
	Sub total				8360	2.69
III	Cost C (Total cost)				310683.53	100.00

5.14 Per hectare yield of teak plantation.

The per hectare yield of teak plantation in Akola district is given in Table.18. While gross returns from teak production were worked out to be ₹ 1562301.

Table 18: Per hectare yield of teak plantation

Sr. no.	Age of felling	Quantity	₹ /unit	Value in ₹	Percentage
1	1st thinning (at the age of 9th year old)				
a	Poles (No)	1200	100	120000	
b	Timber (M ³)				
c	Fuel (tonn)	21.58	1200	25896	
	Per tree produce 0.0059 M ³ timber &				
	Per tree produce 0.0179 tonns of fuel				
	Total			145896	9.34
2	2nd thinning (at the age of 15th year old)				
a	Numbers	550			
b	Timber (M ³)	25.94	11500	298310	
c	Fuel (tonn)	30	1200	36000	
	Per tree produce 0.0471 timber &				
	Per tree produce 0.0545 tonns of fuel				
	Total			334310	21.40
3	Final felling (at the age of 20th year old)				
a	Numbers	550			
b	Timber (M ³)	87.25	11500	1003375	
c	Fuel (tonn)	65.6	1200	78720	
	Per tree produce 0.158 timber &				
	Per tree produce 0.119 tonns of fuel				
	Total			1082095	69.26
4	Gross returns from teak product				
a	Tree harvested (Nos.)	2200			
b	Timber (M ³)	113.19		1301685	
c	Fuel (tonn)	117.18		140616	
	Gross returns from teak product			1562301	100.00

Item wise receipts realized from teak plantation through poles, timber and fuel were ₹ 120000, ₹ 1301685 and ₹ 140616, respectively. The share of poles, timber and fuel wood into gross income from teak plantation was 7.6, 83.32 and 9.00 per cent respectively. This indicates that, in teak cultivation timber wood formed a major source of income. This is obvious also, because teak is grown for harvesting timber only. Poles and fuel wood are the by products obtained in process of production of teak.

Table.19. Result of estimated Cob-Douglas production function for sample teak cultivators

Variables	Regression coefficient
Intercept	3.461
Human labour in days(X_1)	0.407* (0.198)
Bullock labour in days(X_2)	0.178 (0.321)
Expenditure on manures ₹ (X_3)	0.33*** (0.104)
Expenditure on fertilizers in ₹ (X_4)	0.086 (0.121)
Irrigation in ₹ (X_5)	-2.06*** (0.40)
Plant protection in ₹ (X_6)	0.237 (0.343)
R^2	0.481

(Figures in the parentheses are slandered errors of respective regression coefficient)

* Significant at 10 per cent level

** Significant at 5 per cent level

***Significant at 1 per cent level

The production function analysis was carried out using following variables viz, human labour (man days), bullock labour (pair days), manures (₹), total fertilizers (₹), plant protection (₹), irrigation charges (₹) and yield.

It is observed from the Table 19 that, the total human labour (man days) were found positive and significant at 10 % level. Similarly, manures and irrigation were positive and negative significant at 1 per cent level respectively. The coefficient of multiple determination (R^2) was 0.481 indicating thereby 48.16 per cent variation in yield were explained by the factor under consideration. This indicates the appropriateness of the model fitted to data.

The plant protection, total fertilizers and irrigation charges were taken in values as the information on the insecticide used, number of sprays applied, actual number of irrigation given by the cultivator and total fertilizers used were not available as these inputs were recorded by the cultivators in monetary terms. It is because of insecticide and used are not fixed and varied from time to time as per availability. Fertilizers also used in monetary terms as teak plantation required various types of nutrient which were in different forms. Similarly, actual number of irrigation given to teak plantation was not recorded because of loadshedding and availability of water. Therefore, electricity charges were taken.

5.15 Per hectare cost and returns from teak plantation.

The Table.20 shows that per hectare cost and returns from teak plantation.

The Table.20 shows that, the per hectare cost of teak production was ₹ 310684 while, gross returns from teak production were worked out to be ₹ 1562301.

After deduction of the total cost of production of teak from the gross returns fetched in teak growing, residue left over in the form of net returns worked out to be ₹ 1251617.47 and the per year cost were

worked out to be ₹ 15534, per year returns were ₹ 78115 and per year net returns were worked out to be ₹ 62581.

The foregoing analysis revealed that, teak plantation in Akola district was economically viable and lucrative venture.

Negi *et al.* (1990) reported that the productivity for teak comes out to be 69 t/ha/year and 8.2 t/ha/year for gamar.

Table 20: Per hectare cost and returns from teak plantation

Sr. No.	Particulars	Value in ₹.
I	Per hectare total cost and returns	
2	Establishment cost up to 5 years	76335.45
3	Maintenance cost (6 to 20 years)	234348
4	Total cost	310684
5	Gross returns	1562301
6	Net returns	1251617.47
7	B.C. Ratio	5.03
II	Per year cost and returns	
1	Per year cost	15534
2	Per year returns	78115
3	Per year net returns	62581
4	Per month net returns	5215

5.16 Economic feasibility of teak plantation.

While working out the costs and returns from teak plantation. In the above analysis the time factor was not considered. To bring the past and future cost/returns to present worth compounding and discounting technique was used and it was done at 12 per cent and 15

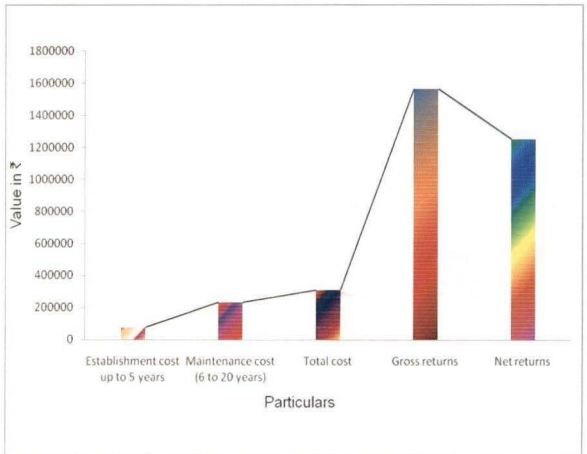


Fig. 2: Per hectare total cost and returns of teak plantation

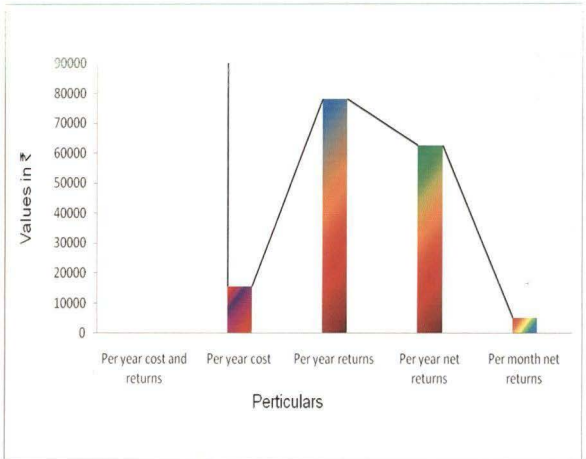


Fig. 3: Per hectare per year cost and returns

per cent. The economic feasibility of teak growing tree was examined by working out the NPV, Benefit cost ratio (B-C ratio) and internal rate of returns (IRR) and the same is presented in Table.15.

Table 21: Economic evaluation of teak plantation

Sr. No.	Parameters	Discount rate at	
		12%	15%
1	Benefit cost ratio	1.69	1.30
2	Net present value (₹)	92232	34609
3	Profitability Index	3.60	1.39
4	Payback period (Years)	9	
5	Internal rate of return (Per unit)	18.39	

Table.21. Indicate net present value, benefit cost ratio and Internal rate of return. Information is presented in Table.21 reveals that the NPV from one hectare of teak trees, at 12 per cent and 15 per cent were, 92232, 34609, respectively for the whole period of plantation.

The B-C ratio for 12 per cent and 15 per cent were 1.69 and 1.30 respectively. The internal rate of return means the rate at which the present value of benefit equals cost. The IRR in present case worked out to be 18.39.

Dilip kumar (1990) examined the implications of applying the economic criterion to the management of teak plantation and shows a positive NPV.

Mehta (1995) reported that an area of 31.5 hectare teak was planted with 5251 seedling allotted to investors; we have invested in total ₹ 4,80,000. The financial analysis carried out by and revealed the

NPV is ₹ 6857, the IRR is 30 to 35 per cent and the benefit cost ratio is 9.6.

Ansari *et al.* (2000) reported that the Barkoli plantation of 21 years old teak recorded maximum NPV at 12 per cent rate and IRR is 31.20 per cent.

5.17 Marketing of teak:

Marketing occupies a prominent place in economic sphere of a developing economy. Generally most of the economic activities are largely concerned with the marketing process. The ultimate objective of almost all production oriented activities is to meet the demands of the people for their own consumption. The products are also demanded in other types of economic activities for the production or performance of different forms of products or services. In order to meet such demands marketing has to play a very significant role. It is rightly defined that "Marketing includes activities involved in the flow of goods and services from production to consumption". The marketing process includes a number of activities for maintaining the constant supply of commodities from the one end of producers to the other end of consumers.

5.18 Marketing channel:

It is observed that, sample activities sold their produce mainly through channel which was

Producer → Wholesaler / Saw miller → Retailer → Consumer.

5.19 Marketing cost incurred by wholesaler:

Knowledge of the distribution of marketing costs among various market functionaries is very important for improving the efficiency of marketing system. The results of analysis of distribution of marketing costs among different functionaries have been presented in Table 22.

Table 22: Item wise per unit cost of marketing of teak wood products in marketing channel

Sr. no	Particulars	Timber (m ³)	Poles	Fuel
A	Marketing cost incurred by producer	-	-	-
B. Marketing cost incurred by Wholesaler/saw miller				
1	Felling of trees and trimming	95.65 (3.24)	0.75 (1.73)	40.59 (15.00)
2	Grading charges	240.00 (8.13)	15.05 (34.79)	10.00 (3.69)
3	Transport charges	540 (18.29)	5.17 (11.95)	65.75 (24.29)
4	Storage charges	450.76 (15.26)	1.8 (4.16)	2.57 (0.95)
5	Processing	52.41 (1.77)	1.65 (3.81)	6.81 (2.52)
6	Handling	41.55 (1.41)	0.90 (2.08)	5.58 (2.06)
7	Miscellaneous charges	310.65 (10.52)	2.50 (5.78)	30.55 (11.29)
	Sub total	1731.02 (58.62)	27.82 (64.31)	161.85 (59.80)
C. Marketing cost incurred by Retailer				
1	Grading charges	110.65 (3.75)	10.55 (24.39)	10 (3.69)
2	Transport charges	440.00 (14.90)	1.61 (3.72)	65.75 (24.29)
3	Storage charges	410.55 (13.90)	0.41 (0.95)	1.1 (0.41)
4	Processing	14.55 (0.49)	0.35 (0.81)	3.08 (1.14)
5	Handling	40.65 (1.38)	0.17 (0.39)	3.78 (1.40)
6	Miscellaneous charges	205.66 (6.96)	2.35 (5.43)	25.09 (9.27)
	Sub total	1222.06 (41.38)	15.44 (35.69)	108.80 (40.20)
	Total marketing cost	2953.08 (100.00)	43.26 (100.00)	270.65 (100.00)

(Figures in parentheses indicate percentage to total)

5.19.1 Timber wood:

The Table 22 reveals that, the per cubic meter cost of marketing incurred by wholesaler for timber. Among the various costs, transportation charges were high which were ₹ 540 which was 18.29 per cent of total cost of timber wood marketing. The second major

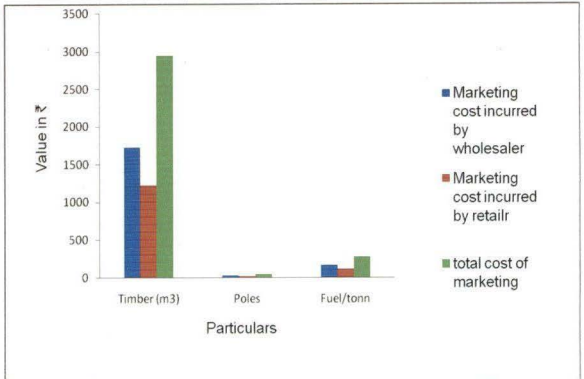


Fig. 4: Marketing cost of teak

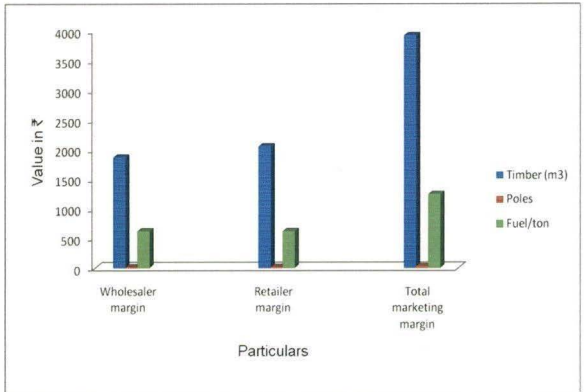


Fig. 5: Marketing margin

constitute of timber marketing was storage charges which was ₹ 450.76 (15.26 per cent), after that the miscellaneous charges, grading, felling of trees and processing cost are constituted about ₹ 310.65 (10.52 per cent), ₹ 240.00 (8.13 per cent), ₹ 95.65 (3.24 per cent) and ₹ 52.41 (1.77 per cent) respectively.

5.19.2 Poles:

The Table 22 reveals that, the grading charges are high in case of marketing of poles which was 34.79 per cent, after that the transportation charge constitutes 11.95 per cent. The miscellaneous charges, storage and processing charges worked out 5.78, 4.16 and 3.81 per cent respectively. Near about 47 per cent marketing cost contributed by the grading and transportation charges.

5.19.3 Fuel wood:

The felling of trees and trimming and transportation were important items of the cost of marketing.

It is seen from Table.22 that, the cost of transportation for fuel wood were 25 per cent, and felling of trees and trimming contributed 15.00 per cent, the miscellaneous ,grading and processing charges worked out about 11.29,3.69 and2.52 respectively.

5.20 Marketing cost incurred by retailer:

5.20.1 Timber wood:

The Table 22 shows the marketing cost incurred by retailer. The Table 22 reveals that the transportation charges are high in marketing of timber wood which were 15 per cent. The storage, miscellaneous, grading and handling charges were worked out about 14.00, 7.00, 3.75 and 1.38 per cent respectively.

5.20.2 Poles:

The Table 22 shows that the marketing cost incurred by retailer. The Table 22 reveals that the 24.39 per cent marketing cost

contributed by grading charges. The miscellaneous, transportation and storage charges were constituted about 5.43, 3.72 and 0.95 per cent respectively.

5.20.3 Fuel wood:

The Table 22 shows that the item wise per unit cost of marketing of teak products by marketing channel.

The Table 22 reveals that transportation cost is 25.00 per cent. The miscellaneous, grading and handling charges were worked out to be 9.27, 3.69 and 1.40 respectively.

Similar results found by the Negi *et al.* (1994). He conducted study of eucalyptus marketing in India.

The present study has clearly brought out that, there was positive relationship between the cost of marketing and marketing functionaries. Hence, to bring down the cost of marketing of teak, it is necessary to reduce the number of marketing intermediaries intervening between the producer seller and ultimate consumer. This would avoid multiplicity of marketing functionaries and there by saving in the cost of marketing. Unwanted multiplicity needs to be avoided in larger interest of the consumer.

5.21 Marketing cost, market margin and price spread:

Knowledge of the distribution of marketing costs among various market functionaries is very important for improving efficiency of marketing system. The results of analysis of distribution of marketing costs among different functionaries have been presented in Table.18.

The price received by producer for timber/ m³, poles and fuel wood/ tonn were ₹ 11500, 100 and 1200 respectively.

The Table.22 reveals that, at over all maximum marketing cost was ₹ 1731.02 per timber / m³, ₹ 1222.06 per timber / m³, while percentage to total cost was 9.42 and 6.65 per cent respectively.

The maximum marketing cost was ₹ 27.82 per pole incurred by wholesaler followed by retailer ₹ 16.34, while percentage to total cost was 16.34 and 9.07 per cent respectively.

The marketing cost of fuel wood ₹ 161.85 fuel wood / tonn (6.00 per cent) incurred by wholesaler followed by retailer ₹ 108.80 (4.01 per cent) respectively.

Table 23: Marketing cost, market margin and price spread.

Sr. No.	Particulars	Timber (m ³)	Poles	Fuel
A. Producer				
1	Price received by producer	11500.00	100.00	1200.00
2	Cost incurred	0.00	0.00	0.00
3	Net price	11500.00 (62.61)	100.00 (58.3)	1200.00 (44.27)
B. Wholesaler				
1	Purchase price	11500.00	100.00	1200.00
2	Cost incurred	1731.02 (9.42)	27.82 (16.34)	161.85 (5.97)
3	Wholesaler margin	1865.00 (10.15)	12.00 (7.05)	230.00 (11.891)
C. Retailer				
1	Purchase price	15096.02	139.82	1591.85
2	Cost incurred	1222.06 (6.65)	15.44 (9.07)	108.80 (4.01)
3	Retailer margin	2050.00 (11.16)	15.00 (8.81)	230.00 (11.91)
D	Consumer purchasing price/retailer selling price	18368.08 (100)	170.26 (100)	1930.65 (100)
E	Total cost incurred by all intermediates	2953.08	43.26	270.65
F	Total margin of all intermediates	3915.00	27.00	460.00
G	Price spread	6868.08	70.26	1510.65
H	Producers share in consumers rupee	62.61	58.73	44.27

(Figures in parentheses indicate percentage to total)

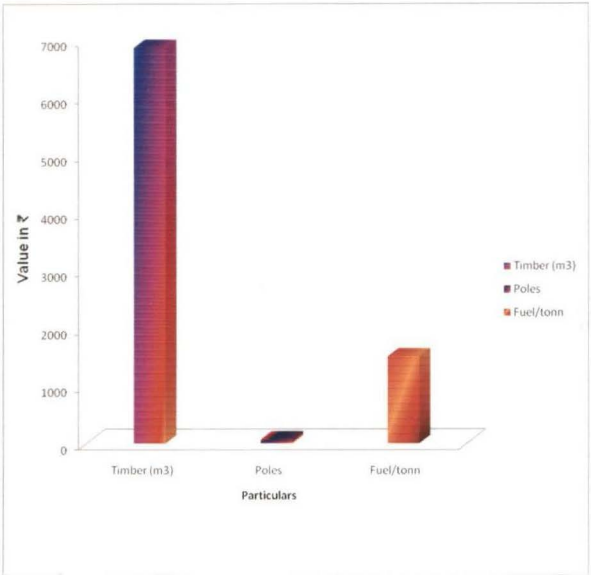


Fig. 6: Price spread

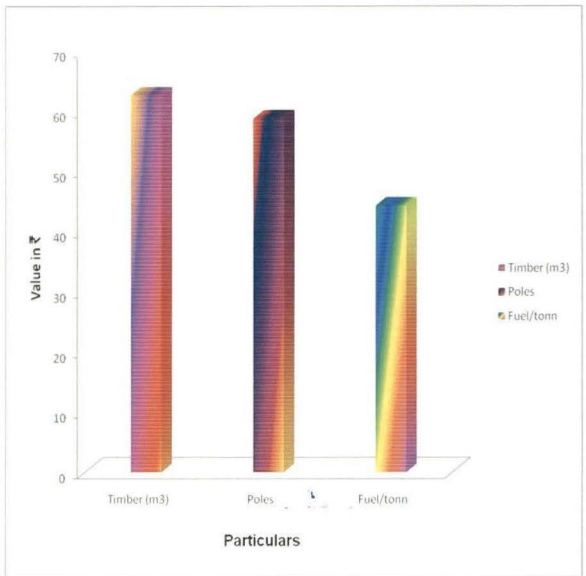


Fig. 7: Producer share in consumer's rupee

5.21.1 Market margins and price spread:

The price spread refers to the difference between the price paid by the consumer and price received by the producer for an equivalent quantity of forest produce. This spread consists of marketing cost and margins of the intermediaries which ultimately determines the overall effectiveness of a marketing system. The price spread studies can be helpful in studying an efficiency of a marketing system. If goods could be moved from the producers to the ultimate consumers at the minimum cost consistent with the provision of services with the consumer's at the minimum cost consistent with the provision of services with the consumer's desire, the marketing system is efficient. Reduction in cost of performance of various marketing functions and improving the standard of service with the same or lower cost represents a clear case of marketing efficiency. At the same time, the provision of additional marketing services that may raise the cost of marketing also represents greater efficiency, if, the consumer value them more than the corresponding saving in cost. If the services provided are the same, then the marketing system of agency that provides these services with the minimum costs is more efficient.

In agriculture and its allied product marketing, it is often believed that, the marketing functionaries absorb a lion's share in consumer's rupee without adding matching utility to the product. It is, therefore, argued and suggested that, the price spread in agriculture and its allied product marketing should be reduced to help the development of agriculture and its allied sector. The reduction in marketing costs and margins can be brought out, if the exact nature of costs involved under a particular set of circumstances is known. When the various cost elements have been distinguished, the basis of each can be appraised and the scope and means of reducing them evaluated.

The Table 23 shows that the wholesaler margin for timber wood, poles and fuel wood were worked out ₹ 1865 (10.15 per cent), ₹ 12.00 (7.05 per cent) and ₹ 230.00 (11.91 per cent) respectively. The

retailer margin is less when compared with wholesaler margin. The retailer margin for timber poles and fuel were worked out about ₹ 2050.00(11.16per cent), ₹ 15.00 (8.81per cent) and ₹ 230 (11.91per cent) respectively and total margin for all teak production product i.e. timber, pole and fuel were ₹ 3915.00, 27.00 and 460.00 respectively.

The total cost incurred by all intermediaries for timber/m³, pole and fuel wood were worked out ₹ 2953.08, 43.26 and 270.65.

The consumer price for timber/m³, pole and fuel wood were ₹ 18368.08, 170.26 and 1930.65 respectively.

The producer share in consumer rupee for timber, pole and fuel wood were worked out 62.61, 58.73 and 44.27.

On per cubic meter basis, retailer margin was higher than that of the wholesaler. Because, retailer had added higher value to wood on account of craftsmanship skills in changing form of wood by conversion into attractive furniture, doors, windows etc. This fetched higher price and there by leaving higher margins to the retailer.

The retailers kept their margin on higher side as compared to that of wholesalers, because their volume of turn over from business of sale of teak poles was lower than that of wholesalers. Hence, to keep themselves in business of marketing retailers were tempted to keep their margin up as compared to the wholesalers. The latter were complacent with their total turnover from sale of teak poles.

An earning of wholesalers and retailers in consumer price of fuel wood was higher than that of timber and pole. The wholesalers and retailers had almost equal share in consumer's price.

Foregoing analysis revealed that, the present study confirmed an established relationship in marketing literature i.e. decline in producers share with an increase in length of marketing chain. However, farm products, including forest tree products, do need a considerable amount of processing before these can be passed on to

consumers. Therefore, the results also could be taken to suggest the need for identifying suitable marketing system and improve efficiency of the same. While, it would be tempting to suggest trimming of length of marketing channel for improving producers share, the same may be most suitable option given the need of different sections of consumers as well as relative marketing advantage to the producers.

Further, it may be concluded that, the cost of marketing and net producers share in consumer price increased with higher degree of processing forest products and vice versa for gross margins of marketing. These findings are in conformity with earlier findings of Negi *et al.* (1994) and Negi *et al.* (1996).

CHAPTER VI

SUMMARY AND CONCLUSIONS

The existing forest is incapable of meeting the large fuel wood and timber wood difficult in the country, growing of teak plantation on farmers field is conceived as the most effective means of raising plantation of quick growing species on all available private lands for meeting the demand.

In vidarbha many farmers have resorted teak plantation on large scale to meet the demand for timber, fuel wood and also for monetary gain and as such it is obvious to have information on economic teak plantation and constraint in teak growing with this in view the present study was undertaken with the following objectives:

- 1) To study the socio economic characteristics of teak growers.
- 2) To estimate the establishment and maintenance cost of teak plantation.
- 3) To worked out the cost and returns of Teak plantation.
- 4) To study the marketing of teak.

The present study was under taken in Akola district. Three tahsils namely Akola, Patur and Barshitakali were selected on the basis of concentration of farmer's growing of teak plantation. 30 villages were selected, by using probability proportion to size method.

The required data were collected by "Interview method". In all 60 farmers were selected. The data were collected by using specially designed and pre tested questionnaire. Simple tabular analysis, regression analysis and project evaluation technique were used to accomplish the objectives. The period of study was 2009-2010.

The results of this study are summarized as follow:

The average size of holding of selected farmers for teak was 1.17 hectares. The percentage of irrigated area was observed to be 44.18 per cent. The cropping intensity was 129.58 per cent of the total cropped area on various selected farmers.

Soybean crop predominated the cropping pattern in all the selected farms. The area under this crop was 28.34 per cent of the total cropped area in selected teak farms. Tur was next important crop; the area under this crop was 11.94 per cent. The area under teak plantation 11.17 per cent of the total cropped area in selected farmers. The area under Agricultural crops 83.48 per cent, Horticultural crops 5.35 per cent, while forest crops 11.17 per cent of the total cropped area of selected teak growers. While the per hectare investment was ₹ 2,16,383/-.

This shows that majority of the farmers who had raised teak plantation belonged to higher economic strata of the society with strong resource base.

Two types of costs are involved in growing teak trees are establishment cost and recurring maintenance cost. The establishment cost consists of all the expenditure required for establishment of teak during first year. Recurring and maintenance cost was ₹ 76,335.45/-

Per hectare cost of maintenance was worked out which were ₹ 2,34,348.08/- and per hectare total cost of teak cultivation was ₹ 3,10,683.53/-

The gross returns per hectare of teak plantation was ₹ 15,62,301/-. The average net returns per hectare was 12, 51,617/-. The per hectare per year cost was ₹ 15,534/- and the average returns per hectare per year of teak plantation was worked out to ₹ 78,115/-.

In order to examine the economic feasibility of teak growers net present value (NPV), Benefit cost ratio (B-C ratio), Profitability index (PI), Payback period (PBP) and Internal rate of return (IRR) were

worked out. Sample as a whole BCR, NPV and PI at 12% discount rate was 1.69, ₹ 92, 232/- and 3.60 per cent respectively. While corresponding figures at 15% discount rates were worked out to be 1.30, 34,609 and 1.39 and Payback period (Years) and Internal rate of return (per unit) was 9 and 18.39 respectively.

This indicates that the parameter of economic feasibility test turned out to be favorable thereby justifying investment of teak plantation which was found economically viable proposition.

In lower and higher discount rate NPV was found more volatile than that of PI and BCR at 12%, while at 15% discount rate NPV was more volatile followed by BCR and PI. This indicates that, even under hypothetically simulated discounts, teak plantation proposition showed economic viability.

The returns realized from teak were worked out to be ₹ 1562301/-. This indicates that, by plantation of teak more returns were obtained. This can be attributed to higher value of teak wood. In view of this, it needs to be encouraged teak plantation on waste lands as well as agricultural lands for economic fulfillment of farmers.

Marketing of teak:

As per concern about markets of teak only one marketing channel was found which is given below.

Producer—→ Wholesaler—→ Retailer—→ Consumer.

The overall net price received by producer for timber/m³, poles and fuel/tonn were ₹ 11500, 100 and 1200. It was observed that the total cost of marketing cost for timber/m³, pole and fuel wood/tonn were ₹ 2953.08, 43.26 and 270.65 respectively.

The overall marketing margin of all intermediaries for timber/m³, pole and fuel wood/tonn was ₹ 3915, 27.00 and 460 respectively. It was also observed that 21.31per cent (timber/m³), 15.86 (per pole) and 23.82 per cent (fuel wood/tonn) share was swallowed by the market

intermediaries, overall price spread for timber wood, pole and fuel wood were 6868.08, 70.26 and 1510.65 respectively. It is revealed from present study was producer's share in consumer rupee from teak products 62.61 timber/m³, 58.73 per pole and 44.27 per fuel wood/tonn.

Conclusions

1. The farmers who had raised teak plantation belonged to higher economic strata of the society with strong resource base.
2. The establishment cost of teak growers was ₹ 76335.45 and maintenance cost was ₹ 234348 and total cost of teak cultivation was ₹ 310684.
3. The gross returns obtained from teak were ₹ 1562301 and the B-C ratio was 5.03.
4. The NPV, PI and B-C ratio at 12% was ₹ 92232, 3.60 and 1.69 and at 15% was found to be ₹ 34609, 1.39 and 1.30 and the PBP was 9 years and the IRR was found to be 18.39.
5. The resource use efficiency of teak plantation were, the total human labour (man days) were found positive and significant at 10 % level. Similarly, manures and irrigation were positive and negative significant at 1 per cent level respectively. The coefficient of multiple determinations (R^2) was 0.481.
6. The only one marketing channel was found i.e. Producer → Wholesaler → Retailer → Consumer
7. The total marketing cost was found to be ₹ 2953.08 for timber/m³, 43.26 per pole and 270.65 per fuel wood/tonn respectively.
8. The total market margin was found to be ₹ 3915 per timber/m³, ₹ 27 and ₹ 460 respectively.

CHAPTER VII

POLICY IMPLICATIONS

Timber wood production of old plantation of 60 to 80 years rotation cycle in naturally regenerated forest has become historical movement with introduction of manmade artificially regenerated intensive plantation. This has reduced rotation of crop cycle to 20 years which produces desired quality of timber with in such a short span as compared to earlier one of 60 to 80 years. Hence, new concept needs to be given momentum for achieving goal of timber production with in time frame. This needs to be looked into by the forest policy makers.

Teak is perennial crop with long gestation period, physiologically under semi-intensive method of teak cultivation the first felling is due at the first felling is due at the 9th year from the date of plantation. Thus, time lag between an investment and income forth coming thereof is of a years, such long waiting period is a test of patience for the investors, especially to the prospective planters for them either they should go in for agro-forestry where in they will be able to get income from arable crops to be grown in combination with tree species during gestation phase of non arable crops i.e. tree species or they should undertake clear felling at an age of 9th year teak growers will be able to get poles only and not timber. The present study brought out that, if instead of timber only poles are to be harvested, the per hectare net income from teak poles worked out to be ₹ 120000/-. An annual per hectare net income from teak pole production under semi-intensive method worked out at ₹ 13333.33/- which is substantial. The present value of future net income for poles@ 12% discount rate for the 9 years worked out to be ₹ 34111/-. Whereas, those who got patience to wait till final or clear felling at 20 years rotation of teak their net income would be ₹ 12,51,657/- with 5.03 BCR and annual net income would be ₹ 78,115/-. Where, as present value of the net income at 12% discount rate for 20 years would be ₹ 92,232.

From the foregoing it is suggested that, teak plantation needs to be expanded on state owned vast waste lands available and marginal lands of private owners even farmers should not hesitate to bring fertile land undertake teak plantation, because none of the arable crop could compete for deriving net income in comparison to teak. The profitability level of teak still could go up than the present level, as it is seen, that, there is wide productivity gap between public and private sector. To overcome a problem of long gestation period agro-forestry approach or model may be replicated. This would compensate scarifies of income by returns to be fetched from each or inter crop during gestation phase. It is interesting to note that present value of future income to be realized in the first felling (9th year) was higher than that of whole rotation (20 years). Hence, farmer may be encouraged.

CHAPTER VIII

LITERATURE CITED

- Agarwal, S. K., P. Khullar, V. K. Dhavan and S. R. Joshi (1994): Growth and yield of *Bambusa tulda* in irrigated and non irrigated plantation in Haryana. *The Indian Forester*. 120(60): 477
- Agarwal. S. K. and V. K. Dhavan (1996): Economics of harvesting and marketing of bamboo. *Indian Forester*. 122(12): 795-799
- Ahmed. P(1989): Eucalyptus an agro-forestry. Its effect on agricultural production and economics. *Agro Forestry systems*. (8): 31-38.
- Aiyeloja, Adedapo Ayo and Ajewole, Opeyemi issac (2006): Non-timber forest products marketing in Nigeria. A case study of Osun state. *Educational research and reviews*. 1(2): 52-58. (<http://www.academicjournals.org>)
- Andrew mittelman (2000): Teak planting by small holders in Nakhon sawan, Thailand. *Unasylya* 201, (51): 62-65
- Anon (1998): Market price of forest products. *Resource survey and management division*. 4(7)
- Ansari. M. Y and Singh. H. p(2007): Economics of teak plantation in Uttarakand. *Indian forester*.133(1): 402-410.
- Balloni. K (2000): Teak investment programmers an Indian perspective. *Unasylya* 201.(51):22-28
- Bhple R. S and Marawar S. S (1999): Constraints faced by growers in use of recommended practices of teak. *Indian. J. of Forestry*. (22): 145-148
- Chaturvedi. A. N (1995): The visibility of commercial teak plantation projects. *Indian forester*, 121 (6): 550-552
- Decamino. R and Alfaro. M (1998): Teak in central America Report to the FAO project. *GCP/INT/ 628/ UK*.
- Diaralal (1994): Economics of mass clonal multiplication of forest trees. *Indian forester*. 120(2): 85
- Dilip kumar P. J (1990): The economics of teak plantation – II. The financial analysis. *My forest*. 26 (1): 73-93
- Gogate, M. G., U. M. Farooqui and V. S. Joshi (1995): Growth responses to irrigation: Eksal (Ambhadi) Teak Plantation – A case Study. *The Indian Forester*. 121(6): 491-502.

- Haque M.S (1996): Intensive management of teak plantations under irrigation on farm lands some observations. *Indian Forester*. 122 (7): 641-645.
- Jayasankar, B. and P. K. Miraleedharan (1993): Bamboo market in Kerala. *Evergreen*. No. 31.
- Jayasankar, B. and P. K. Miraleedharan (1995): Marketing of agro forestry products: A study of marketing of bamboos in Kerala. *J. Trop. Forestry*. 11(11):149-150.
- Krishnan L. Ratha (1998): Relative economics of tree and agricultural crops in Pondicherry union territory. *Indian. J. of Agri. Econ*. 43 (3): 320
- Krishnapillay D. B (1998): A case study of the tropical plantations in Malaysia. *Report to the FAO project. GCP/INT/628/UK*.
- Maldonado G (2000): Challenges of teak in Cote d Ivoire. *Unasyiva*. 201, (51): 36-44
- Marawar S. S, Ingle P. O, Mukewar A. M and deshmuKh R. G (1993): Socio economic analysis of farm forestry in Vidharbha region of Maharashtra state. *Advances in farm forestry research in India*. 9: 219-232
- Marawar. S. S, Mukewar A. M and Zope J. S (1995): Economics of eucalyptus grown on marginal land. *Advances in forestry research in India*. 11;111-115
- Mathur, R. S., S. R. Sagar and M. Y. Ansari (1984): Economics of eucalyptus plantation with special reference to Uttar Pradesh. *The Indian Forester*. 110(2): 97.
- Mathur, R. S., S. R. Sagar and M. Y. Ansari (1984): Economics of eucalyptus plantation with special reference to Uttar Pradesh. *The Indian Forester*. 110(2): 200.
- Mehta U. V (1995): Technical and financial viability of commercial plantation. A study of teak plantation schemes in Gujarat Tamilnadu and Bhopal, India. *Indian institute of forest management. (M. phil dissertation)*
- Mohan jha (1999): A preliminary study on comparative growth and economic returns from rain fed and irrigated teak plantations. *Indian forester*. (8):1198-1203.
- Murugesh, M., V. M. Srinivasan, R. S. V. Rai and S. Balaji (1997): Growth and yield of teak under irrigated condition. *Indian J. of Forestry*. 20(4): 373-376
- Nandagoudar B. S, Mutanal S.M and Hanamashetti S. I (1999): Economics of teak based agro forestry system. *J. of tree sci*. 18 (1& 2): 34-40

- Nandagoudar, B. S. and S. M. Mutanal (1992): Performance of teak in agro-forestry. *J. Tree Sci.* 11(2): 101-106.
- Negi J. D. S., Bahuguna Y. K and Sharma D. C (1990): Biomass production - and distribution of nutrients in 20 years old teak (*Tectonna grandis*) and Gamer (*Gmelina arforera*) plantation in Tripura. *The Indian forester.* 117 (9): 681-686
- Negi, Y. S., S. C. Tewari and L. R. Sharma (1994): Eucalyptus marketing in India. A case study from Punjab. *J. Tree Sci.* 13(2): 79-85.
- Negi, Y. S., S. C. Tewari and L. R. Sharma (1996): Eucalyptus marketing in India. A case study from Punjab. *J. Tree Sci.* 13(2): 79-85.
- Nagpure S. C, Anita G. Rangire, A. B. Thakare and G. G. Jadhav (2007): Marketing of Teak in Maharashtra state- A case study of Gondia Forest Division. *Crop Prot. Prod.* (2007), 3 (2): 28-33
- Odoom F. K (1998): Hardwood plantation in Ghana. A case study for FAO project. *GCP/INT/628/UK*
- Parihar R.B. (2004): Economic Evaluation of Teak Plantation In Yavatmal District. M.Sc. Thesis (Unpub), *Dr.P.D.K.V., Akola*
- Prasad A. N (1993): Economic analysis of *Acacia auriculaeformis* plantation in Gaya district of Bihar. *Indian forester.* 119 (5): 349-353.
- Rajesh K. Rana, Kaushal. P and Negi Y. S(2000): Benefit cost analysis of Agro-forestry tree in eroded soils. A case study of upper swan catchments in district Una (H. P). *Indian forester.* 126(7): 1297-1309.
- Rawat J. K. (1988): Economic consideration in eucalyptus farming. *Indian J. agric. Econ.* 43 (3): 317.
- Rawat, J.K. (1995): Value of a 20 year old irrigated teak plantation. *Indian Forester.* 121(6): 553-557.
- Reddy, C.J. (1995): The bounty from the teak tree. *The Indian Forester.* 121 (6): 573-575.
- Sandhu, S. S. and Gurbaj Singh (1986): Economics of block plantation of (kikar) *Acacia nitotica* Sub spp. *Indica* (Benth) on soils of Punjab. *Indian j. Forestry.* 9(2): 168-170.
- Schminke K. H (2000): Teak plantations in Costa Rica previous woods experience. *Unasylva.* 201 (51):29-35.
- Shammugharvel, P. (1994): A preliminary report on economics of *Bambusa arundinaces* plantations. *J Tree Sci.* 31(1):49-52.

- Sharma R. A (1995): The economics of social forestry in Orissa. *Indian forester*. 121 (1): 241-261.
- Shukla, D. S., M. M. Jaiswal, Y. S. Chavan and Ram Iqbal Singh (1998): Cost-benefit analysis of eucalyptus farming in U. P. with special reference to Kanpur. *Indian J. agric. Econ.* 43(3): 316.
- Singh D. V (1995): Role of forests in rural economy of Himachal Pradesh. *Indian forester*.121 (1): 207-213.
- Vasant P. Gandhi (1999): A decision oriented market information system for forest and agro- forest products in India. Center for management in agriculture, *Indian institute of management*.
- Yadav, R.S.; Munna Ram.; K.R. Solanki, K. Kareemulla and Ramesh Singh (2003): Economic evaluation of agri-silviculture under irrigated condition in Bundelkhand Region of India. *Indian J. of Soil conservation*. Vol. 31 (2): 210-213.

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APPENDIX I

A) QUESTIONNAIRE

Department of Agriculture Economics and Statistics

Title of Project : Production and marketing of teak.

Name of Researcher : Venkatesh S

INTERVIEW SCHEDULE

A) Preliminary information of farmer :

Name of Farmer : _____

Name of Village : _____ Tahsil : _____ District : _____

Age of Farmer : _____ Education : _____

Occupation : 1) Major : _____
2) Subsidiary : _____

B) INFORMATION ABOUT FAMILY

Sr. No	Name of Family Member	Sex	Age	Education	Relation with head
1					
2					
3					
4					
5					
6					
7					

C) LAND USE PATTERN

- 1) Total land : _____ ha.
- 2) Irrigated land : _____ ha.
- 3) Unirrigated land : _____ ha.
- 4) Fallow land : _____ ha.
- 5) Area under cultivation : _____ ha.
- 6) Net sown area under irrigation : _____ ha.
- 7) Area sown more than once : _____ ha.
- 8) Gross cropped area : _____ ha.
- 9) Type of land : _____ (Black cotton/ Light/ Murum)

10) Present value of land

- a) Irrigated : _____ Rs/ha.
 b) Unirrigated : _____ Rs/ ha.
 c) Land revenue : _____ Rs/ ha.

D) Cropping Pattern

Season	Crop	Variety	Area (Ha)
A. Kharif			
1)			
2)			
3)			
4)			

Season	Crop	Variety	Area (Ha)
B. Rabi			
1)			
2)			
3)			
4)			
C. Summer			
1)			
2)			
3)			
4)			
D. Perennial			
1)			
2)			
3)			
4)			
E. Forest Crop			
1) Teak			
2) Bamboo			
3) Other			
a)			
b)			

E) FARM ASSESTS

Sr. No.	Type	Kuccha / Pakka	Present Value (Rs)
1	House		
2	Farm Livestock Shed		
3	Store House/ Godown		
4	Well		
5	Others		

F) LIVE STOCK

Sr. No.	Type	Total Number	Present Value (Rs)
1	Bullock		
2	Cow		
	a) In Milk		
	b) Drought		
3	Buffalo		
	a) In Milk		
	b) Drought		
4	Goat/ Sheep		
5	Poultry		
6	Others		

G) FARM IMPLEMENTS AND MACHINERY

Sr.No.	Type	Total Number	Year of Purchase	Present Value (Rs)
A.	Farm Implements			
1	Iron Plough			
2	Wooden Plough			
3	Harrow			
4	Hoe			
5	Bullock cart			
6	Others			
	a.			
	b.			
	c.			
B.	Machinery			
1	Tractor			
2	Oil engine			
3	Electric pump			
4	Power tiller			
5	Thresher			
6	Sprayer			
7	Others			
	a.			
	b.			

H) INFORMATION ABOUT TEAK PLANTATION

1. Area under Teak Plantation : _____ ha.
2. Number of Teak Trees : _____
3. Year of Planting : _____

4. Age of Plantation : _____
 5. Type of Soil : _____
 6. Planting Material Used : Seed/ Seedling / Stump
 7. Method of Planting : Pit/ Crow bar
 8. Spacing : _____
 9. Source of Planting Material : _____

I) ESTABLISHMENT COST REQUIRED

Sr.No.	Operation	Units used		Rate/Unit	Cost (Rs)
		Male	Female		
1.	Land preparation				
	a) Felling of Trees				
	b) Burning of debris				
	c) Ploughing				
	d) Harrowing				
	e) Levelling				
2.	Planting				
	a) Seed/Seedling/Stump				
	b) Transporting				
	c) Digging of pits				
	d) Transplanting				
3.	Fertilizers (kg)				
	a) FYM				
	b) Nitrogen (N)				
	c) Phosphorus (P)				
	d) Potassium (K)				
4.	Irrigation (Watering) Charges (Rs)				
5.	Intercultural Operation				
	a) Weeding				
	b) Gap Filling				
	c) Watching				
	e)Fencing				
	f) Plant Protection				
6.	Rent of Land if any				

2. Gap filling													
3. Application of fertilizers & insecticides													
4. Irrigation													
5. Pruning													
6. Thinning													

Labour charges-

Male : _____ Rs/hrs.

Female : _____ Rs/hrs.

Machine : _____ Rs/hrs.

K) QUESTIONNAIRE FOR WHOLESALER / RETAILER / CUSTOMER

1. Experience of timber merchant (Years) : _____
2. Year of Establishment of firm : _____

L) ANNUAL TURN OVER

Sr. No	Species	Name of wood	Qty.	Price/unit	Total turn over	Percentage to total turn over
1.	Teak	Timber				
		Poles				
		Fuel				
2.	Misc.	Timber				
		Poles				
		Fuel				

M) SOURCES OF WOOD

Sr. No	Species	Name of wood	Agencies Purchase	Place of purchase	Quantity Purchase	Dist. from shop to place of purchase
1.	Teak	Timber				
		Poles				
		Fuel				
2.	Misc.	Timber				
		Poles				
		Fuel				

N) TRANSPORTATION

Sr. No	Species	Name of wood	Mode of Transportation	Dist. travelled from shop to place of purchase	No. of trips	Transportation charges/ trips including loading staking unloading charges	Total transportation Charges
1.	Teak	Timber					
		Poles					
		Fuel					
2.	Misc.	Timber					
		Poles					
		Fuel					

O) GRADING

1. Do you grade before sale? : Yes / No
2. If Yes, What are the criterias adopted for grading.

Sr. No	Species	Name of Wood	Criteria's adopted				Other Specify
			Girth (Cm)	Length (M)	Girth & Length	Grade	
1.	Teak	Timber					
		Poles					
		Fuel					
2.	Misc.	Timber					
		Poles					
		Fuel					

P) PROCESSING

1. Do you Process wood before sale? : Yes / No
2. If, Yes what process are followed?

Sr. No.	Species	Name of wood	Trimming	Sawing	Proportion of final product obtained	Proportion of by-product obtained
1.	Teak	Timber				
		Poles				
		Fuel				
2.	Misc.	Timber				
		Poles				
		Fuel				

Q) TRIMMING EXPENDITURE

Sr. No.	Species	Name of wood	Qty.trim	No. of labour/day	Labour cost/day	Total cost/day
1.	Teak	Timber				
		Poles				
		Fuel				
2.	Misc.	Timber				
		Poles				
		Fuel				

R) DETAILS OF ANNUAL EXPENDITURE

Sr. No	Particulars	Quantity/ No. of unit	Price/unit (Rs.)	Total Cost (Rs.)
A. Fixed Cost				
1.	Rate of Shop			
2.	License Fee			
3.	Cost of Furniture			
4.	Fan/Cooler			
5.	Permanent labour			
6.	Family labour			
7.	Other fixed cost			
8.	Interest on fixed cost			
Total Fixed Cost				
B. Variable Cost				
1.	Daily paid labours			
2.	Maintenance of Vehicles (Fuel/Repairs)			
3.	Electricity charges			
4.	Telephone charges			
5.	Postage/Stationary charges			
6.	Income Tax			
7.	Sale Tax			
8.	Commission paid to commission agent			
9.	Expenses incurred on hospitality			
10.	Market sales			
11.	Storage charges			
12.	Miscellaneous charges			
13.	Interest on working capital			
Total Variable Cost				

APPENDIX II

Distribution of selected teak growers

Sr.No.	Selection of farmers in Akola District		
	Name of Tahasil	Name of Village	No. of Teak growers
1	Akola	Kumbhari	6
		Chikhalgaon	1
		Shivapur	1
		Chandur	1
		Shisa	3
		Kapasi	1
		Vizora	2
		Yelwan	1
		Goregaon	1
		Dongergaon	1
		Maishang	2
		Kurankhed	1
		Umri	2
		Khadaki	1
Washimba	1		
	15	25	
2	Patur	Patur	1
		Deulagaon	2
		Shirla Andhare	7
		Janephal	2
		Ambashi	2
		Sasti	1
		Nandkhed	2
		Channi	2
		Bhandaraj	2
		Khanapur	1
		Chandni	3
	11	25	
3	Barshitakali	Kanheri Sarap	5
		Waghajali	1
		Kanshivani	3
		Katepurna	1
		4	10
	30	60	

APPENDIX III

Operation wise labour required

Operations	1 st to 5 th year									
	Hired labour in Days		Family labour in days		Bullock labour in Days	Hired labour in Days		Family labour in days		Bullock labour in Days
	Male	Female	Male	Female		Male	Female	Male	Female	
Harrowing	11.5	7.5	7.5	-	19	-	-	-	-	-
Ploughing	9.5	7.5	5.5	-	13	-	-	-	-	-
Layout	8.5	5	4.5	2.5	-	-	-	-	-	-
Digging of pit	13.5	6.5	5.5	2.5	-	-	-	-	-	-
Refilling of pit	10.5	6.5	4.5	-	-	-	-	-	-	-
Planting of seedling	9.5	4.5	4	1.5	14	-	-	-	-	-
Transportation of seedling	8.5	3.5	4	1.5	19	-	-	-	-	-
Weeding (3 times)	13.5	19	4.5	4	-	14.5	36	4.5	2	-
Gap filling	8.5	3.5	3	-	-	-	-	2.5	1	-
Appli. of Fertilizer & Manures	11.5	4.5	4	3	-	42.5	22.5	2	1.2	-
Irrigation	7.5	3.5	1.5	-	-	23.5	13.5	2	0	-
Pruning	6.5	1.5	1.5	-	-	18.5	8	1.5	0	-
Supervision	5	-	3.5	-	-	52	16	2	0	-
Thinning	11.5	7.5	4.5	-	-	35.5	9.5	1.5	0	-
Total	135.5	80.5	58	15	65	186.5	105.5	16	4.2	0

